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October 16, 1989

Mr. Merrill Hohman
U. S. Environmental Protection Agency
JFK Federal Building
Boston, Massachusetts 02203

RE: Comments on "Draft Final Hot Spot Feasibility Study New Bedford Harbor July 1989"

Dear Mr. Hohman:

On behalf of the following defendants:

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Mary K. Ryan
Nutter, McClennen & Fish

Belleville Industries, by its attorneys,
David A. McLaughlin
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Federal Pacific Electric, by its attorneys,
John Quarles
Howard T. Weir
Leslie Ritts
Morgan, Lewis & Bockius

Cornell-Dubilier Electronics, Inc., by its attorneys,
Verne W. Vance
Wendy B. Jacobs
Foley, Hoag & Eliot

Aerovox, Inc., by its attorneys,
Paul B. Galvani
Roscoe Trimmier, Jr.
Ropes & Gray,

Rizzo Associates is pleased to submit the enclosed comments on the above-referenced and related documents. If you have any questions related to these documents, please give me a call.

Respectfully submitted,

Richard J. Hughto, Ph.D., P.D.
Vice President

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Submitted: October 16, 1989

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Defendants' Joint Comments on EPA's Draft Final Hot Spot Feasibility Study for New Bedford Harbor

1.0 INTRODUCTION

The Draft Final Hot Spot Feasibility Study, released by the Environmental Protection Agency ("EPA") on August 2, 1989, for comment, is little more than a multi-million dollar rehash of EPA's "Draft Feasibility Study of Remedial Action Alternatives" dated August 1984. Despite having spent millions of additional dollars, the EPA has still failed to address critical flaws in the much-criticized, and ultimately abandoned, 1984 study.

Among the inexcusable flaws is the Agency's persistent refusal to devote any resources to a meaningful consideration of alternatives to dredging as a remedy. The EPA's failure even to consider seriously other alternatives, such as naturally-occurring biodegradation, enhanced biodegradation, or in place containment, is particularly egregious in view of the results of several significant health studies of the very matter at issue. Studies of New Bedford Harbor residents and of employees of two New Bedford companies which utilized PCBs have both concluded that residents in the New Bedford Harbor area have not suffered adverse health effects as a result of the presence of PCBs in the Harbor. The EPA's current Hot Spot Feasibility Study ("HSFS") is resoundingly silent about these studies, the only studies of what has actually happened -- or rather not happened -- to those living in the area of concern. Rather than consider this real-life evidence, the EPA has irresponsibly chosen to base its assessment of PCB risk solely on academic exercises resting on faulty, unrealistic or unproven assumptions.

Moreover, the study raises -- but fails to resolve -- serious concerns about health and environmental consequences of dredging as a remedy. Unresolved concerns range from the resuspension of heavy metals from the sediments into the water column, to air emissions during dredging and dewatering, to the handling of the heavy metals when dredged sediments are treated and disposed of.

Five years and many millions of dollars later, the EPA still wants to dredge the PCB hot spot in the Acushnet River Estuary but with little more justification today than it had in 1984. Today the EPA assumes that dredging of the hot spot will contribute to the overall remedy of the Harbor. As will be shown in detail below, the EPA has not gathered information or focused its analysis on an overall remedy. Thus, the EPA does not know whether dredging the hot spot will be consistent with an overall remedy or whether it will prove to be a waste of money, time, and resources.

In short, the EPA decision to deal with the hot spot today as an operable unit is arbitrary, capricious, and contrary to law. The EPA itself, in the Hot Spot Feasibility Study, admits that the decision is not based on health risks at all. The EPA cannot articulate a rational basis for its definition of the area it labels "hot spot." Worse, it cannot make the demonstration required by the Superfund Amendments and Reauthorization Act of 1986 ("SARA") that dredging the hot spot will be consistent with the overall remedy for the Harbor since at this time it has no idea what that remedy will be.

The EPA's arbitrary -- and unshakable -- commitment to dredging regardless of how exorbitant the cost or unsatisfactory the result dates back nearly a decade. Early in the 1980's, the EPA, for reasons it has never sought to articulate, wed itself to dredging as a remedy for the PCBs in New Bedford Harbor. In order to support that arbitrary decision, the EPA dedicated millions of dollars to studies of dredging and spent virtually no funds or resources on meaningful consideration of other alternatives. In the words of NUS, the contractor which prepared the 1984 study: "The only way that our study is worth anything would be if we can issue a ROD that establishes that 'dredging' is the only alternative!" See Memorandum entitled Principal Issues by Joe Yeasted, former NUS project manager, undated (copy attached). Hence, the EPA's course was pre-determined from the start.

At no point has EPA veered from its unfounded commitment to dredging. That only dredging has ever interested the EPA is crystal clear from the 1989 Draft Final Hot Spot Feasibility Study, which states: "the focus of the proposed additional studies [following the criticisms of the 1984 NUS study] would be the feasibility of dredging and disposal of contaminated sediment." HSFS, p. ES-2. The 1989 version of the 1984 study again seriously misdiagnoses the problem and the remedy. While denominated a "study," the document displays none of the hallmarks of a true "study," such as thoroughness of documentation and analysis, careful consideration of all relevant factors, or objectivity untainted by bias.

Even though EPA has dedicated millions of dollars to justify its commitment to dredging, it is not too late to take sound and responsible action in this matter: to reject the Draft Final Hot Spot Feasibility Study, as its 1984 predecessor, performed by NUS Corporation, was rejected, and to do what should have been done after that prior rejection -- to work with the defendants and the New Bedford community to develop a scientifically objective study of the problem and a thorough, fair and balanced evaluation of all remedial alternatives.

Health studies performed by the Massachusetts Department of Public Health and the U.S. Centers for Disease Control and substantial work that has already been done by the defendants and their consultants, the results of which are referred to in more detail below, demonstrate that:

1. PCBs do <u>not</u> present a significant public health or environmental hazard to New Bedford Harbor or the Acushnet River Estuary;
2. The Hot Spot Feasibility Study is flawed by numerous technical deficiencies;
3. EPA's failure to consider remedies other than dredging is arbitrary, capricious, and contrary to law;
4. The decision to dredge the hot spot as an interim measure or an operable unit is arbitrary, capricious, and contrary to law;
5. There are other legal flaws in the EPA approach to the Hot Spot and the Harbor; and
6. The administrative record in this case is incomplete.

What is at stake now in the EPA's ill-considered dredging proposal is far more important than face-saving efforts by the Agency to demonstrate that the millions of dollars it has spent to justify its long-held dredging position were not wasted. What is at stake is nothing less than the strong possibility of dooming New Bedford Harbor and the Acushnet River Estuary to a supposed "cure" that would be worse than the disease. Where the disease has been so badly misdiagnosed, and the side effects of the supposed cure so badly misunderstood, a disastrous result is almost assured if EPA proceeds on its current course. Already the EPA's pilot dredging program alone has destroyed acres of wetlands -- a situation for which a private developer would be castigated and sanctioned by the EPA itself.

These comments on the Draft Final Hot Spot Feasibility Study will expand in detail on the six major points raised above and will specifically address various particular aspects of the Draft Final Hot Spot Feasibility Study. Defendants' six major points are, in overview:

1. PCBs DO NOT PRESENT A SIGNIFICANT PUBLIC HEALTH OR ENVIRONMENTAL HAZARD TO NEW BEDFORD HARBOR OR THE ACUSHNET RIVER ESTUARY.

It was not until the early 1970's, following the Yusho incident in Japan in 1968, that concern over possible health effects of PCBs arose. In that incident, individuals in Japan who had consumed contaminated rice oil developed chloracne (a skin disease that affects hair follicles), discolored skin, swelling of the eyes, respiratory symptoms, headaches and numbness and tingling of the extremities. Although later attributed to chlorinated dibenzofurans rather than to PCBs, the event triggered a flurry of studies, with early results suggesting that PCBs caused liver cancer in animals, caused significant clinical illness, and exposed humans in significant quantities through the environment.

In response to these early studies, which were conducted about 15 years ago, Congress enacted section 6(e) of the Toxic Substances Control Act ("TSCA"), 15 U.S.C. §§2601 et seq., in which it required, with limited exceptions, a phased prohibition on manufacture of PCBs, allowing their use only "in a totally enclosed manner." In 1979, EPA followed up the enactment of TSCA by banning most manufacture, processing, distribution and use of PCBs. When tests of New Bedford Harbor indicated high concentrations of PCBs, the Massachusetts Department of Public Health also imposed a ban on fishing and lobstering in certain areas of the Harbor in 1979.

However, as shown in more detail below, recent research and studies have either refuted prior findings or modified the interpretation of such findings. The overall thrust of these recent studies is that the presence of PCBs in the environment does not pose any significant danger to human health. The turnaround in the thinking of responsible scientists about PCBs is most dramatically exemplified by the views of Dr. Renate Kimbrough, a leading EPA toxicologist who was formerly with the Centers for Disease Control. In 1974 and 1975, Dr. Kimbrough co-authored laboratory studies of the effects of Aroclor 1254 and Aroclor 1260 in rats and concluded that only the 1260 formulation appeared to be carcinogenic to the rats. But in 1987 Dr. Kimbrough stated that: "So far, no significant chronic health defects have been causally associated with exposure to PCBs. . . ." "Human Health Effects of Polychlorinated Biphenyls (PCBs) and Polybrominated Biphenyls (PBBs)," Ann. re. Pharmacol Toxical 1987 27; 87-111.

That assessment is borne out by epidemiological studies of workers who were occupationally exposed to high levels of PCBs and of members of the general public who were exposed to PCBs in the environment. Most immediately significant for the New Bedford Harbor situation is the 1987 study by the Massachusetts Department of Public Health, in conjunction with the Massachusetts Health Research Institute and the U.S. Centers for Disease Control, the "Final Report of Greater New Bedford Health Effects Study 1984-1987." That study followed 1981-1982 research by the Massachusetts Department of Public Health which detected high PCB blood levels among some New Bedford residents and attributed these levels to pollution in the Harbor and the Acushnet River Estuary. The 1987 study, called by its authors "the most extensive scientific examination of public exposure to PCBs," found average levels of PCBs in blood serum among 840 randomly selected residents of New Bedford, Acushnet, and the nearby communities of Dartmouth and Fairhaven to be well within the range of five to seven parts per billion, which the Centers for Disease Control estimates is typical for the general U.S. population.

As a result of these findings, the Massachusetts Department of Public Health and the Centers for Disease Control dropped the second phase of the planned study of New Bedford residents. State officials stated that they abandoned Phase II because they had failed to identify sufficient numbers of individuals with high PCB levels to warrant further study even after testing another group expected to have higher levels due to their consumption of seafood from New Bedford Harbor. Inexplicably, the Public Health Study is not even referenced -- much less discussed -- in the Hot Spot Feasibility Study.

In view of these recent findings, the PCB risk assessment for residents of the New Bedford Harbor area which underlies the 1989 Hot Spot Feasibility Study is an inadequate academic exercise with no relation to demonstrated reality. Its purpose was to be the first of three EPA risk assessment documents that would provide the basis for deciding if a clean-up is necessary and if so, how much clean-up. Assuming the first risk assessment showed a clean-up should be performed, the latter documents would show how much clean-up would be necessary to remove the risk. The strongest evidence of the unreliability of the EPA risk assessment is that EPA itself has ignored the document. It has not performed the analyses that it said would appear in the second two risk assessments -- they do not exist. Moreover, the "hot spot" clean-up decision has nothing to do with the risk assessment, for the risk assessment does not address the hot spot that EPA plans to dredge.[1] Indeed, it could hardly do so since the hot spot lies in a submerged and

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[1] An EPA official candidly admitted at the March 20, 1989 Community Work Group ("CWG") meeting that one of the reasons for proceeding with the Hot Spot remediation as an operable unit was the very fact that major studies such as the EPA risk assessment models were not yet complete.

inaccessible location. See HSFS at 3-10, Figure 2-8 and Figure 1-4. Regarding the inaccessibility of the sediments around the Aerovox plant, see, Terra, Inc., Exposure Assessment (Trip Report Memorandum) (October 1989).

The scant three paragraphs in the HSFS devoted to public health risk of the hot spot show that EPA's decision to dredge the hot spot is based on the assumption that small children will play in areas that the Baseline Risk Assessment recognized would not be accessible to small children. Compare HSFS at 3-10 to Baseline Risk Assessment at 2-3, 2-4.

Furthermore, the risk assessment prepared for EPA by Ebasco Services rests on sources and assumptions which, as shown in more detail below, lead to skewed and inappropriate conclusions. It abounds with unfounded assumptions which lead to absurd and erroneous conclusions. This risk assessment takes the concept "conservative" to ridiculous extremes. For example, the risk assessment assumes that two-year olds will be playing in the sediments along the Upper Estuary, after initially stating that children under five would be unlikely to be playing in areas of high contamination. See Baseline Risk Assessment at 4-46-48. In fact, fencing precludes access to most of the Upper Estuary. See, e.g., Deposition of Bernard Gregory Cambra (May 28, 1986), Civil Action No. 83-3882-Y; Deposition of David A. Kennedy (May 28, 1986), Civil Action No. 83-3882-Y; Affidavit of Raymond Castino (October 12, 1989) (copy attached);

Affidavit of Raymond Cabral (October 12, 1989) (copy attached); Affidavit of Gary Hawkins (October 12, 1989) (copy attached). See also Terra, Inc., Exposure Assessment, (October 12, 1989) (Trip Report Memorandum) (copy attached).

Access to Upper Estuary sediments by small children is unimaginable. Yet, without that ridiculous assumption the risk assessment could not conclude that enough contaminated sediments from Area I could possibly be eaten or caked to the skin of an infant to produce "... a potential public health risk." Similarly, EPA in its risk assessment knowingly employs the erroneous assumption that all PCBs in the Harbor are the highly-chlorinated Aroclor 1260. The evidence is to the contrary: neither the CDE nor the Aerovox plants ever used Aroclor 1260. EPA's erroneous assumption in the risk assessment grossly skews the conclusion.

The EPA has also chosen an inappropriate cancer potency factor, as is explained in detail in the risk assessment comments that follow and the Hazard Evaluation by Terra, Inc. (1989). Even EPA utilized a different cancer potency factor -- 2.6 mg/kg/day -- in the Quincy Bay risk analysis. See Environmental Protection Agency 1988 Analysis of Risks from Consumption of Quincy Bay Fish and Shellfish EPA Region I, Boston. Again, without using an exaggerated and overly conservative cancer potency factor in the New Bedford Harbor risk assessment, the risk assessment could not justify the dredging intended by EPA.

That the EPA's risk assessment bears no relation to reality emerges from the complete absence of any evidence that New Bedford residents have suffered any adverse health effects from exposure to PCBs. Residents of New Bedford and employees of the CDE and Aerovox plants have been exposed to PCBs and PCB-contamination for many decades. If PCBs actually pose the risks suggested by the EPA risk assessment, then surely by now the exposed population of residents and employees would be exhibiting health effects from their long-term exposure. Yet, there is no epidemiological evidence that this community has suffered injury from PCB-exposure. (<u>See</u> <u>e.g.</u>, Brown, D.P. 1968. Mortality of Workers Exposed to Polychlorinated Biphenyls and an update. NIOSH Report No. PCB86-206000.) Without a scientifically supportable, realistic assessment of the risk to the affected area, there is no justification for proceeding with <u>any</u> massive remediation program, whether by dredging or otherwise. Superfund monies should be spent to remedy real problems, not theoretically-imagined ones.

Since EPA does not know what the problem is, it cannot know what the solution should be. Fairly and carefully considered, the available evidence demonstrates that no significant health problems are associated with PCBs in New Bedford Harbor or the Acushnet River. Because there is no PCB problem, the EPA should not mandate a PCB solution.

2. THE HOT SPOT FEASIBILITY STUDY IS FLAWED BY NUMEROUS TECHNICAL DEFICIENCIES.

A. If there is any meaningful public health or environmental hazard in the area, it is related to the presence in the harbor of fecal coliform and pollutants other than PCBs.

A basic flaw in the EPA's approach to the remediation of New Bedford Harbor is that it focuses only on PCBs, a demonstrated non-problem, and ignores the contaminants that constitute the real problem. In evaluating proposed remedies for PCBs, the HSFS acknowledges that the dredging remedy will not eliminate pollutants such as lead, polycyclic aromatic hydrocarbons ("PAHs"), or coliform which continue to enter the Harbor environment on a daily basis.

Defendants do not categorically deny that there is any environmental problem from contamination of New Bedford Harbor. Rather, defendants' position is that any such problem derives, not from PCBs, but from the presence in the Harbor and the Estuary of substantial quantities of lead, PAHs, fecal coliform from raw sewage, coal tars from oil spills, runoff, and industrial and municipal discharges. The adverse health effects of these contaminants, unlike PCBs, are well established. Yet the EPA virtually ignores these contaminants in its 1989 Hot Spot Feasibility Study. A person reading the study is led to believe that if only the PCBs could be made to disappear, the Estuary and Harbor would be pristine. Such a belief is ridiculous.

Dredging will simply aggravate the problem posed by the real pollutants: disturbance of the harbor sediments through dredging will resuspend metals and PAHs in the water, where they can do the most harm. Dredging and incineration of harbor sediments, EPA's "preferred" remedy, will simply move the metals and other non-combustible compounds from one location to another. This purported remedy is precisely the type of risky and inadequate "fix" deemed inappropriate by SARA. In the process, environmental damage and disruption may occur from the resulting air emissions and volatilization which have been predicted but not analyzed by EPA. See 1989 Draft Final Hot Spot Feasibility Study at 2-19, 3-3, 5-12. Failure even to consider other contaminants and the effects of the proposed remedies thereon is a critical defect in the Hot Spot Feasibility Study.

B. The dredging remedy is ill-conceived and technically unsuitable.

First, EPA has never provided a coherent or consistent definition of the so-called "hot spot," which is the area to be dredged. The definition of the hot spot is not based on scientific, technical or risk bases. Rather, it reflects political expediency. BY EPA Region I's calculations the removal of 10,000 cubic yards of sediment should cost less than $30 million. At that cost, the Region's decision and activity would be immune from interference and oversight by EPA Headquarters in Washington, D.C. (Civattieri announcements to CWG on March 20, 1989.) To that end, Region I estimates that those areas where PCB concentrations exceed 4,000 parts per million ("ppm") in the sediment total approximately 10,000 cubic yards and can be handled by Region I as an "operable unit" without involving EPA Headquarters. Hence, the hot spot is now defined as those areas containing concentrations of at least 4,000 ppm of PCBs. Remarkably, earlier EPA definitions of the hot spot also involved 10,000 cubic yards of sediment, although 10,000 ppm was the concentration number. (Ebasco, 1987.)

The sampling results gathered specifically to define the hot spot have not been provided by EPA to the defendants; only the final numerical concentration has been reported. It appears that EPA and its consultants had no additional laboratory analytical data available to them so that they could validate the data prior to using it since the backup data needed to validate the results is not available or in the Administrative Record. Any scientist knows that unvalidated data should typically not be considered reliable data. Despite this glaring and dangerous omission in the science supporting the hot spot operable unit, the EPA is proceeding full steam ahead with its alleged $14 million dredging program.

Second, as indicated above, EPA and the Corps of Engineers have failed properly to address the problem of resuspension of a multitude of contaminants during the dredging and handling of sediments. When EPA planned its pilot study of dredging, it purposefully chose secluded areas of the Upper Estuary which contained low levels of PCBs and which were subject to low tidal currents. At that time, during a meeting between representatives of EPA, the Corps of Engineers, and the defendants on February 18, 1988, in specific verbal response to defendants' comments on the pilot dredging program, EPA claimed it did not intend to extrapolate information obtained during the pilot study to the hot spot. Accordingly, the pilot study was not designed or implemented in a fashion that would generate information about the effects of dredging on resuspension and transport of contaminants from the hot spot. That information is still missing. It is, however, key to the proposed dredging program.

Third, there is no data that has been collected by the government and released to the public showing that the Confined Disposal Facility ("CDF") built to contain the dredged spoils works. Visual observation suggests that significant subsidence and erosion has occurred, jeopardizing the integrity of the structure.

Finally, as proposed in the Hot Spot Feasibility Study, dredging would visit immense environmental disruption and damage on New Bedford, and EPA's studies do not prove the contrary. Dredging would:

* Resuspend in the water column contaminants, such as heavy metals and PAHs, which are presently buried in the sediments;

* Cause air emissions and volatilization of various contaminants;

* Destroy the habitats of shellfish and other organisms on the harbor bottom and in the riverbed; and

* Ultimately reverse the natural processes which are ameliorating environmental problems which have resulted from a century of industrial and municipal contamination. By these processes contaminants become bound to the sediments and over time become covered by "clean" sands and silts. Left unimpeded, this natural process will continue to occur in this marine environment. In the James River, for example, this so-called "armoring" of pesticides in sediments has allowed state officials in Virginia to reopen closed portions of the river to crabbing and fishing. Substantial dredging as proposed by the EPA could obviously wreak havoc with these natural "armoring" processes.

Not only is clean sediment tending to cover pollution from the past, but also there is strong evidence of the biodegradation of PCB compounds. Scientific research, including investigations for General Electric Corporation, have demonstrated that Aroclors (the trade name for PCB mixtures produced by Monsanto) will break down or degrade under conditions present in marine environments. Furthermore, scientists say that the dechlorination process can be expedited by adding natural constituents such as yeast to an environment. Such natural processes, possibly enhanced by an outside agent, appear fully adequate to remedy PCB contamination.

A far less drastic, and less potentially damaging, approach than dredging would be adequate and appropriate. Yet, such approaches have been arbitrarily eliminated from consideration by EPA without any genuine analysis. Unless and until EPA considers other alternatives and considers the Harbor as a whole, hasty implementation of a make-shift remedy for the so-called hot spot is ill-considered, arbitrary, capricious, and inconsistent with the National Contingency Plan ("NCP").

3. EPA'S FAILURE TO CONSIDER REMEDIES OTHER THAN DREDGING IS ARBITRARY, CAPRICIOUS, AND CONTRARY TO LAW.

Although the EPA readily admits its obligation to consider all available remedial alternatives, for six years it has given serious consideration to, and spent serious money on, only one -- dredging. In light of all the evidence, it is not overstating the case to say that the EPA has spent six years and many millions of dollars not to evaluate all remedial alternatives but to justify a single pre-selected alternative -- dredging. A brief review of the EPA's effort makes this clear beyond any doubt (and indeed, to our knowledge the EPA has never seriously denied it).

The 1983 Remedial Action Master Plan (RAMP) emphasized dredging. In the summer of 1984, Gerald Sotolongo, EPA project officer for the New Bedford Harbor Superfund site, announced the following alternatives as those being considered for the Acushnet River north of the Coggeshall Bridge:

1) No action;

2) Dredge 1 1/2 miles of the river and store sediments in a bottomless structure along the river at a cost of $28 million;

3) Dredge 1½ miles of the river and store sediments in a lined container along the river at a cost of $80 million;

4) Dredge 1½ miles of the river and ship off-site at a cost of $44 million;

5) Rechannel the river flow, containing and capping on one side at a cost of $25 million.

Of the four alternatives requiring any action, three involved dredging.[2]

By October, 1984 public dissatisfaction -- indeed outcry -- with EPA's five alternatives forced the agency to at least give lip service to considering other options. Thus, on October 27, 1984, the New Bedford Standard Times quotes Sotolongo stating "It's just our responsibility, (to consider all the alternatives)" while he announced EPA's decision to reconsider two alternatives for disposing of the dredged

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[2] Illustrating that EPA had long ago eliminated nondredging alternatives, even those Sotolongo announced as having been considered but rejected for inclusion in the list involved dredging and varied from those included only because the method of disposal was different. (New Bedford Standard Times article, July 21, 1984). As the month went on Sotolongo continued publicly to discuss alternatives, but the discussions focused only on options for disposal of the sediment after it had been dredged. On August 24, 1984, he announced the "pineapple upside down cake method," which involved burying excavated (i.e., dredged), sediment beneath clean sediment in the river bed.

sediment -- incineration and biodegradation.[3] At no time has EPA seriously considered -- or spent funds to investigate or study -- options which do not involve dredging.

In late November 1984, David Pickman, Public Affairs Spokesman for EPA Region I, announced that even capping, the single alternative which did not require dredging, had been rejected. He stated that EPA's chosen methods were (1) dredging and disposal in a partly lined container and (2) dredging and trucking sediments off site. See New Bedford Standard Times, November 30, 1984.

Once it had publicly announced dredging as its remedy of choice, EPA was so anxious to begin the process that it proposed a "fast track" dredging program, a plan which called for beginning to dredge the "hot spots"[4] located in the Upper Estuary before even completing its study of the remainder of the Harbor, as was required by Superfund. Government agencies' and public protests about the safety and feasibility of dredging prompted EPA to contract with the Army Corps of Engineers for further studies. See Draft Pilot Study of Dredging and Dredged Material Disposal Alternatives,

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[3] In fact, it is possible to use biodegradation methods on sediments containing PCBs while that sediment remains on the harbor floor or river bed. Even though biodegradation may offer a permanent solution to any potential problems caused by the presence of PCBs without disruption to the environment, there is no evidence that EPA has ever considered the use of such a method. Lake, et al (1989).

[4] The term "hot spots" has been widely used to describe areas with particularly high concentrations of PCBs.

Superfund Site, New Bedford Harbor, Massachusetts (September 1987). Michael R. Deland, then Regional Administrator for EPA Region I, conceded in May 1985 that EPA would delay issuance of its Record of Decision ("ROD") because of concern that dredging "could be more of a health hazard than living with PCBs where they were." See New Bedford Standard Times article May 24, 1985. He acknowledged that further study of the New Bedford Harbor problem was needed.

Nonetheless, all further study by the Agency has focused on justifying dredging as the chosen remedy. In the words of the contractor which prepared the 1984 hot spot study for EPA: "The only way that our study is worth anything would be if we can issue a ROD that establishes that 'dredging' is the only alternative!" Memorandum entitled Principal Issues by Joe Yeasted, former NUS project manager, undated (copy attached). At no point has EPA veered from its unfounded commitment to dredging.

Instead of initiating a broader study which would include serious consideration of other remediation methods, EPA poured millions of dollars into studying only dredging methods and methods for disposal of dredged material. That only dredging interested the EPA is crystal clear from the 1989 Draft Final Hot Spot Feasibility Study, which states: "the focus of the proposed additional studies [following the criticisms of the 1984 NUS study] would be the feasibility of dredging and disposal of contaminated sediment." HSFS Study,

p. ES-2. See also p. 1-5. The Corps of Engineers' Engineering Feasibility Study, had only one stated purpose: to demonstrate the safety of dredging. By 1987, the EPA announced that it would pour still more money into its chosen remedy by conducting a Pilot Dredging Program to test dredging in the Harbor itself.[5]

By July 1988, the Pilot Dredging Program was well underway at a cost of millions of dollars. EPA continued publicly to discuss options but again limited the options to those that involved dredging. For example, on July 12, 1988, Frank Ciavattieri announced an alternative using liquified propane gas to extract PCBs from sludge. He stated, "This process proposed by CF Systems Corp. offers a third alternative, but all require dredging." Each time a nondredging method was raised, it was either dismissed or assigned a low priority.

By proceeding blindly toward a dredging remedy, EPA improperly, arbitrarily, and capriciously foreclosed consideration of other feasible, less environmentally

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[5] The extreme emphasis placed on dredging is illustrated by EPA's expenditure of funds in 1987. During that year, EPA committed $6.5 million dollars to the Army Corps of Engineers. Most of this amount was spent on the pilot dredging study. This stands in striking contrast to EPA's allocation of $462,000 to explore detoxification and biodegradation technologies, despite their statutory preference embodied in §121 of SARA. Indeed, even the requests for proposal issued for these technologies did not address in-situ biodegradation but instead focused on biodegradation and destruction/detoxification technologies as an adjunct to dredging, which is a very different matter.

destructive remedies. Moreover, in view of the demonstrated insignificance of PCBs as a public health or environmental concern, a massive, expensive and potentially harmful remedy such as dredging is simply not justified. The natural process of biodegradation of PCBs is observed and ongoing. There is no imminent or substantial endangerment. EPA has ample time to consider approaches other than dredging.

One such promising cure that has been utterly ignored by EPA in its zeal to dredge is natural or enhanced biodegradation. The science of anaerobic degradation of PCBs is relatively new since 1982. More and more evidence of this natural process has been unearthed and explored by the scientific community. Although the defendants have repeatedly forwarded available evidence to EPA, EPA has steadfastly refused to consider the process or devote any significant sums of money to a meaningful investigation or analysis of this promising remedial alternative. See Comments of Defendants on DART, submitted to EPA on June 30, 1988.

Yet, as recently as August 1989, some EPA staff have been urging the Agency to conduct research on biodegradation before selecting a remedy for the hot spot. See Lake, et al., Dechlorination of PCBs in Sediments of New Bedford Harbor, dated August 30, 1989. Their recommendations have fallen on deaf ears at the Agency. Notably, in New York, state officials set aside plans for a multi-million dollar dredging project in the Hudson River in the face of evidence that PCB-biodegradation offered a more promising solution.

The persistent refusal of EPA to consider biodegradation in a meaningful way flies in the face of the mandate of SARA to study and implement innovative remedies. The EPA apparently wears blinders that permit it only to see and fund dredging as a remedial alternative. If half as many dollars were spent by EPA on the investigation of biodegradation and other, less environmentally disruptive remedies, then dredging would fall from the Agency's esteem. However, the Agency's decision-making process has been skewed from the outset to favor dredging. No other option has received fair or meaningful consideration by the EPA.

4. <u>ADDRESSING THE HOT SPOT AS AN INTERIM MEASURE OR AN OPERABLE UNIT IS ARBITRARY, CAPRICIOUS, AND CONTRARY TO LAW.</u>

The EPA Region I decision to conduct a five-acre hot spot as an operable unit, separate from analysis of an overall approach to remediation of New Bedford Harbor, is arbitrary, capricious and contrary to the dictates of SARA and the National Contingency Plan ("NCP"). Not only does EPA's Hot Spot Feasibility Study admit that the decision to clean up the hot spot is not based on risk and that ARARs will not be achieved, but the EPA makes no effort to explain how this remedial measure will be consistent with other remedial activities, if any, the agency may take in the Harbor in the future. SARA and the NCP expressly require the

EPA to provide a clear and documented explanation of the consistency of an operable unit with the overall site remedy, particularly when the operable unit itself will not achieve ARARs, and of the cost-effectiveness of any operable unit. See Section 121(d)(4) of SARA, 42 U.S.C. §9621(d)(4); 40 C.F.R. §300.68(c)(3); 53 Fed. Reg. 51393, 51503, 51507 (December 21, 1988). In its Hot Spot Feasibility Study, the EPA does not provide the required explanation because it cannot justify this operable unit.

Instead, the decision to proceed with this operable unit rests on politics, pure and simple. EPA's studies are not complete, but Region I will not wait. EPA Region I's spokesperson actually announced at a public meeting on March 20, 1989 that EPA would conduct the hot spot cleanup for policy and political reasons. Thus, cleanup of the Harbor has been reduced to political gamesmanship between EPA Region I and EPA Headquarters. Region I has publicly acknowledged that by selecting an operable unit that would cost less than $30 million, the Region could proceed without obtaining approval from EPA Headquarters for undertaking the action.

Thus, the interests of the statute and the New Bedford community have been sacrificed to the game: Region I cannot quantify how much PCB will be removed by the dredging remedy; it does not know the effect such a cleanup will have on the rest of New Bedford Harbor or on an overall remedial program;

and, it has admitted that the dredging operation is unrelated to its assessment of risk. In short, EPA is not in a position legitimately to proceed with this operable unit.

The NCP defines an "operable unit" as "a discrete part of the entire response action that decreases a release, threat of release, or pathway of exposure." 40 C.F.R. §300.6 (1988). At least two conditions must be met for an operable unit to be implemented before selection of an appropriate final remedial action: (1) the operable unit must be "cost-effective"; and (2) it must be "consistent with achieving a permanent remedy." 40 C.F.R. §300.68(c)(3)(1988). See also 50 Fed. Reg. 5868/1 (Feb. 1, 1985). Likewise, revisions to the NCP proposed in December 1988 continue to require operable units to be cost-effective and consistent with the Agency's overall cleanup plan for a site.

> "Operable unit" means a discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration, or eliminates or mitigates a release, threat of release, or pathway of exposure. . . . Operable units will not impede implementation of subsequent actions, including final action at the site.

53 Fed. Reg. 51477-78 (December 21, 1988) (to be codified at 40 C.F.R. §300.5). Proposed §300.430 also provides that "[t]he remedial action process at a site may be conducted through the use of an operable unit initiated at any time prior, during, or after the RI/FS when sufficient information is available to support selection of a remedy to address a

particular site problem, a specific portion of a site, or the entire site." 53 Fed. Reg. 51503/3 (December 21, 1988) (emphasis added). As is demonstrated throughout these comments, such information is not available here.

In setting forth the principles by which it intends to manage the Superfund remedial program, EPA states that "[t]he appropriateness of dividing remedial actions into operable units is determined by considering the interrelationship of site problems and the need or desire to initiate actions quickly." 53 Fed. Reg. 51423/3 (December 21, 1988). EPA explains that "[t]o the degree that site problems are interrelated (e.g., contaminated soils and ground water), it may be most appropriate to address the problems together." Id. On the other hand, "where problems are reasonably severable, phased responses implemented through a sequence of operable units may promote more rapid risk reduction." Id. Lacking a strategy for the overall Harbor, EPA cannot justify treating the hot spot as an operable unit. Indeed, dredging the hot spot does not conform to any of the examples of appropriate operable units developed by EPA in the preamble to the NCP revisions.

Typically, operable units are designed: (1) to "address the most imminent threat"; (2) to "stabilize a threat posed by the site"; (3) to "undertake a discrete, well-defined portion of the project while developing the overall remedial action"; or (4) "for logistical and technical reasons." 53

Fed. Reg. 51399/1-2 (December 21, 1988). EPA does not, and cannot, contend that this case involves an imminent or unstable threat. Nor is this the type of logistical and technical operable unit contemplated by the regulations, such as "where demolition and treatment of waste in tanks on a site is the first operable unit to facilitate locating equipment or materials handling for staging the second unit, which may be cleanup of an adjacent lagoon or contaminated soils on the site." Id. Lastly, as indicated throughout these comments, EPA has not adequately defined the hot spot or analyzed the effect of the proposed dredging to justify handling the hot spot as a "discrete" unit.

The EPA Region I decision also contravenes SARA and the NCP because it does not meet the conditions for implementing an operable unit before the appropriate final remedial action is selected. EPA Region I does not know and indeed cannot know whether its proposed hot spot action will be cost effective, as it cannot quantify the extent to which the remedy will be effective for reducing the alleged human health and environmental risk posed by PCBs in the Harbor. Similarly, EPA Region I cannot determine whether the cleanup will be consistent with the permanent remedy because it does not know the effect that the action will have on the rest of New Bedford Harbor; nor can it know what actions it may take in the rest of the Harbor until the conclusion of the Agency's RI/FS process for New Bedford Harbor. The Agency predicts that it will not complete the Feasibility Study for the entire New Bedford Harbor Superfund site until at least the spring of 1990.

EPA Region I does not have sufficient information to select an appropriate remedy for either the five-acre "hot spot" or the remainder of the Harbor since EPA does not model the effect of the remedial proposal on the Upper Estuary or the Harbor. Moreover, EPA has not yet analyzed the data from the pilot dredging study to know what the overall impact of dredging will be relative to PCB fate and transport (although it is clear that given the way EPA designed the study, officials would not be able to predict that effect).

For all these same reasons, the Agency cannot make the required demonstration as to the waiver of ARARs for this operable unit. The proposed NCP reiterates current EPA policy that "[a]ll remedial action will require evaluation of the nine criteria" established for the detailed analysis of alternatives. 53 Fed. Reg. 51393, 51503. These criteria include a demonstration of compliance with ARARs or justification for a waiver therefrom.[6]

EPA statements that the operable unit is a political expedient seem all that is borne out by the facts. The law, however, does not allow use of operable units just because the Agency wants to "do" something to satisfy political

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[6] Because EPA fails to make either required demonstration, we are not in a position to comment on its handling of specific ARARs.

expediency. The law plainly and clearly permits operable units only to advance overall clean-up objectives at Superfund sites in a cost-efficient manner. Both the objective of such a cleanup (i.e., "reduction of overall risk") and cost efficiency are missing in the New Bedford cleanup until a RI/FS and strategy for an overall approach to New Bedford Harbor have been developed by EPA.

Nor can this action be characterized as a proper interim action in the sense that this action is sequenced with or supports successive remediation. To the contrary, it may effectively foreclose or impede a more cost-effective, less environmentally-disruptive solution.

Finally, dredging of the hot spot could never be said to represent a response to a pressing problem that will worsen if unaddressed since EPA has never claimed in the 12-year history of the site that there is need for quick action. Indeed natural sedimentation processes and biodegradation are part of the healing process already improving the condition of the Harbor. EPA Region I wishes to conduct this operable unit for policy and political reasons, to "count a bean" in fiscal year 1990, having failed to make its fiscal year 1988 or 1989 cleanup goals in Region I and across the country.

5. THERE ARE OTHER LEGAL FLAWS IN THE EPA APPROACH TO THE HOT SPOT AND THE HARBOR.

A. By dividing its remedial program into pieces and units, EPA is violating numerous environmental protection laws.

EPA has consistently and cavalierly violated the spirit and letter of various federal and state environmental protection laws in its development of this operable unit. First, EPA claimed that it needed no permits or approvals to conduct its pilot dredging program. That program resulted in dredging and destruction of acres of wetlands, banks, and submerged lands to create the CDF and the CAD units. Such activities ordinarily require extensive analysis and review under the Massachusetts Environmental Policy Act ("MEPA") as well as permits under a host of other statutes including the Clean Water Act, the Massachusetts Wetlands Protection Act, and the Coastal Zone Management Act.

Under the shield of the Superfund program, EPA claims exemption from the permitting and review processes. While CERCLA does eliminate for EPA the inconvenience of obtaining actual permits for on-site work, it does not exempt EPA from compliance with the spirit and substance of environmental protection laws. Congress expected EPA to conduct the necessary analysis and scrutiny of its proposed actions and to perform the functional equivalent of the permit application process.[7] In this matter, however, EPA has blithely ignored its own environmental protection mandate in its zeal to conduct the pilot dredging program. Now, under the aegis of a so-called hot spot operable unit, EPA will compound the errors of the pilot dredging program.[8]

In a much more massive dredging project, which poses substantially greater environmental and public health risks, the EPA again seeks to ignore the substance and spirit of environmental protection laws. Importantly, the object of MEPA, which is not a "permit law" but instead a broad-based environmental review procedure, is to examine site-specific environmental effects of a project before the project is implemented so that site-specific mitigation measures can be required if necessary. EPA cannot use SARA and a piecemeal approach to a Harbor remedy to circumvent MEPA and other environmental protection laws.

That such circumvention is EPA's strategy is obvious. The CDF is a prime example. EPA plans to leave the CDF in

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[7] EPA's own guidance (Superfund Innovative Technology Evaluation (SITE) Strategy and Program Plan) states: "No permitting will be necessary for demonstrations carried out at NPL Superfund sites. However, OSWER will conform to the functional equivalent of any applicable or relevant and appropriate laws and regulations as required by the ... NCP...."

[8] EPA is apparently relying on the fact that hot spot remediation is an operable unit to excuse a less than thorough screening of the nine criteria whose consideration is mandated by SARA and the NCP, although governing law excludes compliance with only one of the nine criteria.

place forever. No restoration or replication of the destroyed wetlands is proposed in the HSFS, as would ordinarily be required under Mass. Gen. Laws Ch. 131, §40. Construction of that CDF improperly escaped MEPA review although it triggered several MEPA review provisions, including 301 CMR 11.26(7)(b)3, 4, and 8. The elements which triggered MEPA review included construction of a solid fill structure of 1,000 square feet in base area under water, construction of a dike involving dredging of 27,000 cubic yards, and alteration of more than 500 feet of a waterway bank.

The extensive and intrusive activities contemplated in the Hot Spot Feasibility Study would entail yet more environmental disruption for which there has not been adequate analysis or consideration. Nor has EPA made any effort to comply with the spirit of other water and wetlands protection laws which require at a minimum a careful analysis of the impacts of dredge and fill activities and, most importantly, a careful consideration of alternatives to the proposed dredging and destruction of wetlands. Indeed, under the Clean Water Act, courts have overturned decisions to issue dredge and fill permits due to failure of the Corps of Engineers to undertake adequate consideration of alternatives before issuing the permit. See, e.g., Sierra Club v. U.S. Corps of Engineers, 614 F. Supp. 1475, 1515 (D.C. N.Y. 1985). At no time has EPA performed any such analysis. EPA has improperly elevated CERCLA over all other laws. That, however, is not a power Congress has delegated to the EPA.

Before EPA wreaks further havoc with the environment in New Bedford, it must conduct a genuine analysis of (1) the impacts of the hot spot dredging program on water and air quality and (2) alternatives to indefinite use of the CDF. Because the pilot dredging program was conducted in an area utterly unrepresentative of the hot spot, data for this required analysis is not currently available.

6. THE ADMINISTRATIVE RECORD IN THIS CASE IS INCOMPLETE.

The United States District Court recently held in this case that the validity of the EPA's determinations concerning remedial measures for the harbor is to be determined on the basis of the Administrative Record,[9] judged by the standard of whether the decision is arbitrary, capricious, or otherwise not in accordance with law. In light of that ruling, it is critically important that the Administrative Record underlying the HSFS contain all material required for an adequate explanation of why the Agency defined the hot spot as it did, why it opted to proceed with remediation of that area as an operable unit prior to completion of its studies of overall remediation of the harbor, and why it chose dredging and incineration, and rejected other possible

[9] Defendants expect to challenge this ruling on appeal and continue to pursue their request for an adjudicatory hearing before the agency.

remedial measures, for the hot spot. Judge Young expressly stated that his decision on the scope and standard of review was premised on the assumption that EPA would, in concert with the defendants, develop a full administrative record that would adequately address all defendants' concerns.

In addition to the many shortcomings in the HSFS which are apparent from what the EPA has chosen to include in the administrative record, it appears to defendants that EPA has improperly excluded from the administrative record significant materials that should, as a matter of law, have been included in the record. It is well established in this Circuit and elsewhere that a legally adequate administrative record must include all materials which the Agency considered in making its decision on what action to take -- here, dredging and incineration -- as well as its decision on what alternatives to reject -- here, such proposed alternative is no action and in place containment. See e.g., Maine v. Kreps, 563 F.2d 1043 (1st Cir. 1977) (Department of Commerce directed to supplement the administrative record to enable reviewing court to determine whether Agency made rational weighing of all relevant considerations); Conservation Law Foundation of New England v. Clark, 590 F. Supp. 1467 (D. Mass. 1984) (Court will allow administrative record to be supplemented to "show factors the Agency should have considered but did not"); Environmental Defense Fund v. Blum, 458 F. Supp. 650, 661 (D.D.C. 1978) (Agency may not "skew the record for review in its favor by excluding . . . information in its own files which has great pertinence to the proceeding in question").

To defendants' knowledge, the EPA has excluded from the administrative record such obviously pertinent materials as an environmental risk assessment for the harbor and sampling data for the harbor collected by the U.S. Army Corps of Engineers. At a minimum, drafts of such pertinent documents should have been provided, as defendants have requested repeatedly, even if final versions were not available. Defendants suspect that many other highly pertinent materials contained in the EPA's "Site File" for the site and perhaps elsewhere have also been excluded from the administrative record.

The EPA "Site File" contains extensive material at the EPA record center that has not been included in the administrative record but which defendants believe is relevant to EPA's selection of remedial action. Examples include: (1) an EPA memo of April 27, 1982 from James Okum stating that "[i]n Region I's evaluation of the New Bedford Harbor PCB problem, we have recognized that the removal of highly contaminated harbor sediments is likely to be part of any remedial action program; (2) a memorandum attached to an EPA agenda for a public meeting held on December 8, 1982 stating "we are soliciting support for the funding of PCB removal from New Bedford Harbor"; and (3) the Yeasted memorandum quoted earlier in these comments.

Defendants request that the EPA work with them to ensure that all pertinent materials from the EPA files be included in the administrative record so that we can minimize the need to supplement the administrative record in the event it comes up for judicial review.

2.0 BASIS FOR DEFINING THE HOT SPOT

EPA has been arbitrary in its definition of the hot spot as the operable unit for the upper estuary. This is clear from (1) the extreme variations in the estimates of PCB mass that the Agency has publicly opined are in the so-called "hot spot;" (2) the approach that the Agency has labeled as "common sense" for picking a PCB concentration level to define the hot spot; (3) EPA's disregard for evaluating the cost-effectiveness of the remedy in violation of its operable unit guidance; and (4) a lack of precedent for selecting a 4,000 ppm cleanup level.

Variability in EPA estimates of PCB mass in hot spot reveals arbitrariness of agency action.

Between January 1989 and August 1989, when the HSFS draft was released, EPA has, on different occasions, publicly proffered various estimates of the total PCB mass in the Harbor which EPA believes lies in the so-called hot spot. At times, the estimate has been 45%; at times, 75%; at times, somewhere in between. EPA and its contractors have repeatedly revised their estimates of this percentage without explanation for the changes. Both the gross variation in the estimates over a short time period, coupled with a lack of explanation for changes in the estimate, cast real doubt on the veracity of the estimate and demonstrate the arbitrariness of EPA's decision process.

The rationale for implementing an operable unit action originally appeared to be based on the fact that EPA believed that 75 percent of the PCB mass in the Harbor existed in a relatively small area with a volume of 10,000 cubic yards. Despite the fact that the "hot spot" being considered is now only estimated to contain 45 percent of the source, the momentum for undertaking a hot spot interim remedy has continued.

In addition, the volume of sediment would have to be removed in order to meet the varying PCB reduction targets has increased by a factor of 20, striking at the heart of EPA's arguments in support of the hot spot removal as an interim remedy/operable unit. Originally, 10,000 cubic yards would have had to be removed to attain EPA's November 1988 goal of 90% removal of PCB mass. Now, EPA estimates that two hundred thousand cubic yards would now have to be removed to achieve the 90% goal. See, HSFS.

<u>EPA's rationale for using the 4000 ppm target level is unstated and capricious.</u>

On page 2-5 of the HSFS, the concept of optimizing the PCB mass reduction in defining the hot spot is discussed twice. However, no objective or scientific criteria and no supporting documentation are presented for EPA's specific approach. Rather, according to EPA, "common sense" underlies its current definiton of the Hot Spot as sediments containing in excess of 4,000 ppm PCB." Not only is EPA's approach lacking in common sense, but it is arbitrary.

To support the "common sense" ap proach, EPA compiled Table 2-1 of the HSFS, a data summary, which it says demonstrates that 48 percent of the PCBs in the upper estuary sediments are in areas with concentrations of 4,000 ppm or greater. The data in Table 2-1 also indicate that 45.5 percent of the mass is contained in areas at 10,000 ppm or higher. Thus, EPA states that since there is a nominal difference in the percentage of total mass, and there is only a difference of 1,300 cubic yards of material between 10,000 ppm and 4,000 ppm hot spots, it is common sense to choose the 4,000 ppm cleanup level.

A more careful examination of the data in Table 2-1 indicates that there is in fact not an obvious optimal action level and certainly not one that is based on "common sense." The incremental percentages of mass in decreasing the action level from 30,000 to 20,000 ppm and 20,000 to 10,000 ppm are 9.8 percent and 3.7 percent, respectively. Decreases in target levels beyond 10,000 ppm result in increasingly smaller increases in mass removal, indicating that a point of diminishing returns is reached at 10,000 ppm and that lower action levels do not provide significant additional mass capture.[1]

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[1] Oddly enough, EPA predicts that 200 cubic yards would be added for each 1,000 ppm decrease in action level from 10,000 ppm to 5,000 ppm. Defendants submit that this prediction is highly suspicious since it is highly unlikely that such a uniform distribution of PCB actually exists in the environment.

The HSFS does not present an explanation of how the numbers in Table 2-1 were computed or compiled. Defendants have reviewed the Corps of Engineers' data summary[2] to understand the method that EPA used to define the hot spot area and the computations that led to the data in Table 2-1. Our review of the data that exists in the Administrative Record indicates that the difference between a 10,000 ppm and 4,000 ppm targeted cleanup level is approximately 100 percent difference in volume of material, not 14.6 percent as indicated by EPA in Table 2-1. Defendants' computation appears to be partially confirmed by Figure 2-8 in the HSFS itself which indicates that substantially more than 14.6 percent increase in volume would be involved at the 4,000 ppm cleanup level, in contrast to the volume of sediments at a 10,000 ppm level.

EPA has disregarded its own "operable unit" guidance by defining the hot spot as 4,000 ppm.

The technically acceptable practice for evaluating an operable unit is a cost-effectiveness analysis in which the cost of treating different sizes of hot spot is analyzed in comparison with the resulting benefits. Natural breakpoints

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[2] See, January 31, 1989, Letter from Charles Bering, ORC to Rizzo Associates transmitting "Chemical and Physical Analysis of Sediments from Hot Spot Areas," November 1987, USACE-NEP. On pages 2-5 and 2-7 of the Draft Final Hot Spot Feasibility Study (HSFS), the five data sources utilized to define the hot spot are listed. The primary and most recent source is the Corps of Engineers' 1988 sampling round during which samples were collected for PCB analyses in the upper estuary.

typically emerge from cost benefit analyses at a point above which the unit cost for additional treatment is not commensurate with the benefits. For example, above a given action level the unit cost of additional treatment may increase dramatically compared with the resulting benefits.

A cost-effectiveness analysis was not performed for the Hot Spot by EPA. The data used to define the size of the hot spot in volume and concentration must be presented, along with information on the benefits of treating the sediments at different action levels. Benefits can be quantified in terms of reduced risk, water quality improvements, or increased dollar benefits resulting from an improved resource.

More important, failure to perform a cost-effectiveness analysis is in direct opposition to EPA's own guidance on operable units which states that the action must be cost-effective and consistent with the overall remedial action selected for the Harbor, as stated on page 1-9 of the HSFS. If the hot spot definition is not risk-based[3] and a cost-effectiveness analysis has not been performed, the cost-effectiveness and consistency of the action with a permanent remedy cannot be demonstrated. Therefore, the requirements for implementing an operable unit action have not been satisfied.

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[3] On page ES-4 of the HSFS, EPA states that the selection of the "4,000 ppm target concentration limit is not risk-based."

EPA stated in a briefing to the Community Work Group in March, 1989, that one reason for going forward with the operable unit is that it would be a remedy costing less than $30 million and which would not require EPA Headquarters concurrence. Definition of a hot spot based on an arbitrary concentration level or by a desire to keep the cost under regional approval levels is not technically justifiable and does not represent a cost-effective approach to remedial action or expenditure of public funds.

There is no precedent for the use of a 4,000 ppm target cleanup level for other Superfund sites.

Finally, there is no precedent for utilizing 4,000 ppm as a hot spot definition in sediments at other Superfund sites. On the contrary, at the Outboard Marine Site in Waukegan Harbor, Illinois, EPA utilized a sediment hot spot concentration of 10,000 ppm for an area with a similar contamination condition to that found in New Bedford Harbor.

EPA must undertake a scientifically and legally valid definition of the Hot Spot.

EPA must fully present its data; its methods of analysis; its rationale for selecting the action level for the hot spot; its methods for computing the volume of contaminated sediments at different action levels; the analysis of the cost-effectiveness; and the rationale for assuming that the action is consistent with the action that will be taken for the entire site, in order that the public may be fully informed of the costs and benefits of the program. Significant changes in the data analysis results have been submitted by EPA, but the recommendations of the HSFS have not changed as a result, revealing EPA's strong bias to do something, whether or not technically justified. The program goals must be reviewed and the most current data analyzed to develop a rational and technically justifiable approach to the "hot spot" definition.

3.0 COMMENTS ON RISK ASSESSMENT ELEMENTS OF THE HSFS AND THE THE DRAFT BASELINE PUBLIC HEALTH RISK ASSESSMENT

3.1 Introduction

This section of Defendants' general comments evaluates the technical adequacy of the Draft Final Baseline Public Health Risk Assessment, New Bedford Harbor Feasibility Study (referred to as the "risk assessment") prepared by E.C. Jordan and released by Ebasco Services, Inc. to the Environmental Protection Agency (EPA) in August 1989 (Ebasco 1989).[1/] The comments follow the structure of a typical risk assessment, with sections organized by chemicals of concern, exposure assessment, toxicity evaluation, estimates of potential risk, and characterization of uncertainty.

Because risk assessment is not an exact science, it is critical that risk assessments convey plausible and reasonable evaluations of potential risks. The New Bedford Harbor risk assessment does not meet a test of reasonableness. The potential risks posited by Ebasco are the result of a series of assumptions about exposure and dose-response relationships that are extreme overestimates. A consequence of combining many overly conservative assumptions is that the

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1/ We must note that the statement in the HSFS that the public health risk assessment was released in June 1989 was wholly aspirational, not factual. The study was finally released to the public on August 16, 1989.

final estimates of potential risk are unreasonably high. A general principle of risk assessment is to make conservative assumptions at each stage so that the final estimates of risk will not underestimate potential risk. This dictum, however, does not justify what EPA has done, the construction of unreasonable combinations of exposure conditions and characterizations of dose-response relationships that are biologically implausible.[2/]

Each of the assumptions used in a risk assessment is more or less uncertain and therefore introduces uncertainty into the final estimates of risk. The New Bedford Harbor risk assessment fails to adequately characterize the orders of magnitude of uncertainty in the estimates of risk presented by the hot spot operable unit. The discussions of risk in the risk assessment and the HSFS imply a severe and present danger to public health and fail to acknowledge that estimated risks are based on the assumed conditions of arbitrary exposure scenarios that apply only to a hypothetical population, not real people who live and work in the City of New Bedford. The exposures were derived from conservative assumptions that greatly overestimate actual exposures of the local population.

2/ For example implausible lifetime cancer risks as high as 10^{-1} are estimated.

3.2 Characterization of Chemicals

3.2.1 Selection of Chemicals of Concern

On page 2-14, Ebasco states that "Exposure to PCBs was evaluated for all routes of exposure. When or if the exposure levels for PCBs were considered insignificant, exposure to cadmium, copper, and lead was then evaluated." Such a selective approach, especially in combination with EPA's decision to ignore the polycyclic aromatic hydrocarbons in the harbor that will still be there after dredging, clearly demonstrates that EPA's goal is not accurately to assess risk, but simply to go forward with dredging.

3.2.2 PCBs in Sediments

3.2.2.1 Characterization of Sediments

The risk assessment characterized concentrations of PCB mixtures in sediments from New Bedford Harbor as total PCBs.[3/] and improperly evaluated their risk as though all the

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3/ Sample results indicating "not detected" ("ND") were also assigned a default value of 10 percent of the analytical limit of detection. This assumption is inappropriate because there is no evidence to support the presence of non-detected contaminants to any degree. Indeed, the Massachusetts Department of Environmental Protection suggests the use of a value of zero for all non-detects.

PCBs were Aroclor 1260. Characterizing all PCBs as one entity is misleading because the PCB mixtures in the sediments vary in composition (i.e., extent of chlorination) and the toxicity of different commercial PCB mixtures varies widely (see Section 4).

In its simplest form, characterization of the composition of PCB residues in sediments could have relied on the Aroclor- and homologue-specific analyses presented in the data bases. The analytical data sets used in the risk assessment characterized the PCB mixtures as approximations of commercial Aroclor mixtures. An analysis of shoreline sample points along the Fairhaven shore failed to detect PCB residues that would properly be characterized as Aroclor 1260. Limited data were also available regarding homologue compositions. A more complicated principal components analysis should also have been performed, similar to the characterization of PCB residues in seafood.

Total PCB concentrations were used for quantitative estimation of potential risks because it is EPA risk assessment policy to treat all PCBs as a single toxicologic entity, similar to a particular Aroclor mixture. This policy creates uncertainties because Aroclor mixtures change in the environment. Thus, to aid characterization of uncertainties that result from this policy, the composition of the PCB mixtures at the sediment exposure points should have been described in some manner.

It should also be recognized that EPA's characterization of PCB residues in seafood (Appendix E of the risk assessment) is completely inappropriate when applied to describe the composition of sediment PCBs. Residues of PCBs in animal tissue are the result of complicated pharmacokinetic processes that have selectively favored the retention of specific congeners, as EPA points out in Appendix D of the risk assessment. PCBs are enzymatically hydroxylated by biota to produce derivatives that can be excreted. This process occurs at different rates in different species and at different rates for different congeners. Congeners that are metabolized slowly are retained in tissues for greater periods of time than those that are metabolized quickly. In general, as the rate of chlorination increases, the rate of metabolism decreases. PCBs in sediments have never been subjected to these pharmacokinetic processes, and the PCB congeners present would be expected to have very different profiles than PCB residues in biota.

In Appendix E, EPA acknowledges that characterizing the composition of the PCB mixture in seafood is a means of gaining insight into obtaining more accurate estimates of the potential risks associated with ingesting seafood. Similar insights would be valuable for estimating potential risks posed by exposure to PCBs in sediments, which EPA analyzed for risk of ingestion and dermal absorption into the body. EPA failed to analyze PCBs in New Bedford Harbor in the same manner as PCBs in Quincy Bay. Potential upper bound incremental lifetime cancer risks posed by PCBs in seafood in Quincy Bay were evaluated using a site-specific cancer potency factor. Potential risks at Quincy Bay were evaluated using a cancer potency of 2.6 mg/kg/day derived for exposures to Aroclor 1254. Potential risks were evaluated for New Bedford Harbor using an erroneous cancer potency of 7.7 mg/kg/day.

3.2.2.2 Concentrations of PCBs in Shoreline Sediments

EPA states that the exposure scenarios described in the risk assessment and in Section 3 are likely to take place along the edge of the water or in the wetlands areas of the estuary shore. Appendix A of the Feasibility Study (Ebasco 1989) presents sampling locations and concentrations of PCBs that were detected. Based on Figure A-1, samples were identified to characterize typical concentrations along the Fairhaven-Acushnet shore that were adjacent to the shoreline or within the wetlands areas designated on the map. The results are presented in Table 2.1.

A pattern of PCB concentrations in sediments along the Fairhaven-Acushnet shore is apparent. PCB concentrations in sediments north of the electrical substation tend to be considerably higher than in sediments south of the substation. Two distinct areas of contamination along this shore can be defined.

When the results of Table 2.1 are compared with sediment concentrations of PCBs used in the risk assessment (risk assessment Table 2-5), it appears that the concentrations of PCBs in sediments at locations at which periodic exposure can be expected have been greatly inflated in the risk assessment. The risk assessment assumed values of 149 ppm and 399 ppm PCBs for the lower estuary eastern shore. Table 2.1 indicates that 17 and 67 ppm are more reasonable estimates of the concentrations along this shoreline. Similar results are apparent for the upper estuary eastern shoreline. The risk assessment assumes a maximum value of 6,393 ppm PCBs; Table 2.1 indicates a maximum value of 701 is more reasonable.

3.2.3 PCBs in Ambient Air

The risk assessment inappropriately characterized ambient air concentrations of PCBs. Only limited air data were available to assess risks associated with inhalation exposure to PCBs. As a result, PCB concentrations in air above the mudflats in the estuary were used to characterize ambient air concentrations at other locations in the New Bedford area. The risk assessment acknowledges the inappropriateness of this approach (pp. 2-34 and 4-50), yet posits estimates of potential risks using the mudflat ambient air data nonetheless.

The risk assessment also estimates potential risks posed by background PCB concentrations, apparently assuming that the site contributes a major portion of the PCBs in ambient air in New Bedford. It is inappropriate to assume that all background PCBs originate from the site, and it is probable that a variety of emission sources are responsible for background concentrations of PCBs. The background air concentration in New Bedford was stated in the risk assessment to be 10 ng/m^3. The citation for the source of this number was given on page 2-34 as NUS (1986); however, this document was not included in the reference list and as a result, this number cannot be verified. Nevertheless, if valid, 10 ng/m^3 is a typical concentration of PCBs in urban air in the United States (ATSDR 1989), making it doubtful that emissions from the mudflats contribute significantly to ambient air concentrations of PCBs in New Bedford.

The risk assessment also assumed that all PCBs are in the vapor phase and not adsorbed to particulates. In fact, PCBs have a very low vapor pressure (ATSDR 1989), and it is unreasonable to assume that PCBs in ambient air would not tend to absorb to dust and other particles.

3.3 Exposure Assessment

Exposure assessments are performed by identifying: locations at which exposure is likely to occur (exposure points), the environmental media and routes through which exposure might occur (exposure pathways), the population that is likely to be exposed (receptors), and specific scenarios describing the frequency and duration of exposure. In the absence of actual exposure information, EPA customarily uses a series of simplifying assumptions to characterize expected exposures at a site (EPA 1986). In this case, however, EPA has used erroneous simplifying assumptions.[4/]

4/ Furthermore, EPA ignored actual exposure information which should have been used. See deposition testimony of David Kennedy and Bernard Cambra, May 28, 1986, Civil Action No. 83-3882-Y. Government counsel cross-examined both deponents.

EPA's Guidelines for Exposure Assessment encourage the use of realistic assessments based on the best data available. Worst-case estimates are not encouraged (EPA 1986b). Nonetheless, EPA ignored its own guidelines in performing the exposure assessment and instead manufactured potential risks by linking together a series of implausible worst-case exposure assumptions. As set forth below, the New Bedford Harbor risk assessment has failed to demonstrate the reasonableness of key assumptions and evaluates exposures that are unlikely to occur; potential risks that are estimated for the site are calculated under the terms and conditions of implausible exposure scenarios.

3.3.1 Exposure Points

Very few observations of human activity patterns and land uses specific to the upper estuary are provided in the risk assessment. Demographic and land-use data that are presented in Chapter 2 are for the entire Greater New Bedford area, and are inadequate to characterize activities that may occur at a discrete location. Activities that are appropriate for the general area are not always plausible for the estuary. For example, frequent use of public beaches in the bay area was cited as a justifying reason for assessing swimming or wading exposure at unlikely locations such as Marsh Island or the upper estuary (page 2-10). Apparently survey information that indicated people fish in the bay north of Rickerson Point was used to support EPA's assumption that individuals could catch their entire seafood diet from the upper estuary region (pages 2-7, 2-10, 4-20). Detailed comments are provided below.

3.3.1.1 Acushnet River Estuary

The risk assessment refers to the New Bedford side of the estuary as having unrestricted access (pages 2-10 and 2-18), and thus considers human exposure to sediments in this area likely. This is not true. Most of the property along the shore is industrial, with access limited by security fences, gates, and bulkheads. Access to the shore from the industrial properties is further restricted by rip-rap (boulders used to limit shoreline erosion) and other debris. At selected locations along the New Bedford shore, individuals could enter industrial properties and approach the river, but at most industrial properties, guarded gates and fences would make entry unlikely. It is not accurate to imply that access is unrestricted at most areas along the New Bedford side of the estuary. See Depositions of David Kennedy and Bernard Cambra, May 28, 1986, Civil Action No. 83-3882-Y; Affidavits of Raymond Castino, Raymond Cabral, and Gary Haskins, executed October 12, 1989; Terra, Inc., Exposure Assessment with attached Memorandum to File, October 1989.

The risk assessment considered the cove area and mudflats near the hot spot as likely places for exposure of the local population on the New Bedford side of the river (Figure 2-7). The mudflats, however, are located adjacent to manufacturing facilities with restricted access because of fencing and bulkheads that preclude access to the shoreline. (See Terra, Inc., Exposure Assessment, Oct. 1989, Memorandum to the File.) The risk assessment hypothesizes that individuals could hike along the shoreline and approach the mudflats. However, it is hardly plausible that people would hike from that point when there is a closer, more convenient access point to the shore near the Wood Street bridge, a distance of approximately 1,500 feet. No field observations of human activity near the mudflats were provided to support the assumption that people would continually return to the mudflats. The risk assessment has inadequately supported the choice of the mudflats as an exposure point for the general population.

The cove area, however, has relatively unrestricted access from the parking lot of an adjacent industrial facility on Belleville Street. It would be possible for individuals to approach the river at this location. The shoreline is covered with thick strands of grass and bushes, however, and access is not easy. No paths were observed that would indicate individuals were frequently approaching the river.

On the Fairhaven side of the estuary, access is generally unrestricted (Terra 1989). Most of the Fairhaven shore of the estuary is undeveloped and extensive salt grass marshes are present along the shoreline. Mechanized access is limited, but individuals could approach the river by hiking and climbing across the tidal marshes and through underbrush. An undeveloped road apparently used by all-terrain vehicles extends from South Main Street to the electrical utility substation west of Burt school. Tracks from the vehicles did not extend to the river, however. The lack of convenient access is an important criterion for the determination of potential receptors and exposure scenarios, as discussed in the following sections.

3.3.1.2 New Bedford Harbor

The risk assessment selected Marsh Island, Popes Island, and Palmer Island as exposure points inside the harbor (Figure 2-7). The presence of Marine Park at Popes Island makes this a suitable location for selected recreational activities. No explanation is provided, however, for the selection of Marsh Island and Palmer Islands as exposure points. No observations of actual activity patterns or discussions of ease of access are provided for these locations in Section 2.2, Land Use Within the New Bedford Harbor Site. General observations of the harbor made by GCA were presented (page 2-9), but no observations specific to the exposure points are provided. The risk assessment also describes the GCA observations as not representative of year-round conditions (page 2-7).

Considering the length of time that field work has been performed by EPA at this site, field observations of activity patterns at the actual exposure points should be available. The selection of Marsh and Palmer Islands as potential exposure points is inadequately supported.

3.3.2 Exposure Pathways

The risk assessment selected sediments, surface water, and biota as the common pathways of exposure at all exposure points. Exposure to ambient air containing PCBs was also evaluated for the residential areas near the upper estuary.

3.3.2.1 Estuary

No site-specific observations were provided to support the assumption that sufficient shoreline activity occurs in the estuary area to make shellfishing and swimming/wading plausible recreation activities (page 2-18). The risk assessment reported the field observations of GCA, which stated that the Acushnet River in the estuary region is very dirty with brown and pungent water, oil stains, and trash (page 2-9). The GCA observations indicate a low potential for recreational activities in the estuary, and the risk assessment presents no evidence to counter this indication.

The assumption in the risk assessment that fishing/clamming and swimming/wading are plausible exposure pathways in the estuary (page 2-18) is inadequately supported. The estuary has been closed to shellfishing for decades due to sewage contamination. The historical shellfishing closure should indicate that regular and continuous harvesting of clams at estuary mudflats by the same individual for 10 years is not plausible. Shellfishing is an obvious activity and is noticeable from a distance. No observations of shellfishing in the estuary were provided. If shellfishing were to occur in the estuary, it would at most be episodic and infrequent.

Inhalation of ambient air was evaluated despite the acknowledgement in the risk assessment that any extrapolation of measured air concentrations at the mudflats to other receptor locations may not be appropriate (page 2-34). Because of the acknowledged deficiencies in characterization of this pathway, it was inappropriate to quantify inhalation exposures.

3.3.2.2 Harbor

The risk assessment reported the GCA observations that in the upper harbor (near Marsh Island), the river shows visual signs of pollution and had a pungent odor (page 2-9). No evidence is presented to support the contention in the risk assessment that recreational activities are likely to occur at Marsh Island (page 2-18). The assumption that fishing and wading/swimming are plausible exposure pathways at Marsh Island is inadequately supported.

Marine Park on Popes Island was considered in the risk assessment to be a plausible location for swimming/wading. The rip-rap lining the shore of the park, the adjacent industrial use of the land and shoreline, and the absence of a beach makes this a very unlikely location for swimming, however (Terra 1989).

3.3.3 Potential Receptors

Site-specific characteristics defined by the exposure point and pathway should determine the receptor subpopulation that is likely to be exposed. The risk assessment, however, fails to adequately consider conditions specific to the exposure points in its determination of the probable receptors.

Inadvertent ingestion of sediments was evaluated only for young children 0-5 years of age because of age-specific, hand-to-mouth activities that make this age-group most susceptible to soil ingestion (page 2-24). However, the young child is also the receptor who is least capable of contacting sediments in areas of the harbor and estuary that lack convenient public access.

The risk assessment has incorrectly classified all infants, children, women of child-bearing age, and elderly persons as sensitive receptors. The errors in this classification, which results in classifying one-half the population as sensitive, include the following. Although infants and small children are typically considered a sensitive subpopulation, such consideration should be based on data about the specific chemical substance and exposure being evaluated, not based on size alone. Second, including all women of child-bearing age is an inappropriate extension of the usual prudent categorization of pregnant women as a sensitive population. Obviously, not all women of child-bearing age are pregnant. Third, the risk assessment wrongly assumes that all elderly persons are sensitive receptors because they all have underlying diseases, compromised immune function, or chronic illness.

3.3.3.1 Cove Area

The cove area is a shallow bay with thick vegetation and stands of salt grass along the shore. The risk assessment describes the cove area as a location at which very young children could be exposed to sediments because of proximity to a playground (page 2-22) (totally ignoring that the more accessible exposure point is EPA's own CDF). The playground has a six-foot high chain-link fence that is in good repair. The fence connects the adjacent industrial facility's security fence at the east end of the playground and extends to Belleville Street at the west end. Swings are located near the fence, approximately 300 feet from the street. This is the most suitable area of the playground for young children.

To contact the sediments, toddlers would have to escape from their guardian, walk approximately 300 feet along the fence inside the playground, reach the street, and then backtrack an additional 300 feet along the opposite side of the fence to reach the river.

Very thick stands of vegetation would have to be negotiated to reach the water. At high tide, the shoreline is vegetated to the water's edge, and sediments would be covered. Only at low tide, when unvegetated sediments are exposed, could sediments be contacted. Access to the river by a toddler at this location is implausible.

3.3.3.2 Fairhaven Shore of the Estuary and Harbor

Three locations in the estuary and harbor along the Fairhaven shore were designated as potential exposure points for toddlers: Marsh Island, the upper estuary, and the lower estuary. These locations are all characterized by a lack of convenient mechanized access, and the need to hike through woods and marshes to reach the shoreline. For toddlers to ingest or contact the sediments at these locations, they would have to be carried to the shore and deposited in the sand or water. The implausibility of this EPA assumption is obvious. Indeed, the risk assessment contains no documented observances of toddlers in this area, much less documentation of EPA's assumption that children 0-5 years old would be playing in the sediments 1-20 times per year.

3.3.3.3 Nearby Residential Locations

It is irresponsible to predict inhalation exposures to PCBs at residential locations, especially considering the acknowledgement in the risk assessment that the evaluation may be inappropriate. All other pathways incorporated voluntary exposure of the receptors (e.g., the receptor had to travel to the river for exposure to occur). The inhalation pathway predicts involuntary exposure at people's homes, which can unnecessarily and inappropriately cause concern among the local population.

3.3.4 Exposure Scenarios

The selected exposure scenarios do not incorporate site-specific characteristics, and are implausible. The risk assessment acknowledges that recreational activities (and exposure to contamination) would be more common in the lower harbor/bay area than in the estuary (page 2-10). Yet, the frequency and duration of exposure of adults and older children for the estuary/upper harbor are identical to those used for the lower harbor/bay region. The scenarios are discussed below for each pathway.

3.3.4.1 Contact and Ingestion of Sediments

The risk assessment uses the unreasonable assumption that young children will be exposed to sediments at the more limited access areas of the harbor (Marsh, Popes, and Palmer Islands) which do not have public beaches as often as they would be exposed at the public beaches. (Forts Rodman and Phoenix), 20 to 100 times per year (Table 2-6).

For contact of sediments by older children and adults, it is also assumed that the frequencies of exposure in the estuary, harbor, and bay are similar. This is unreasonable. The underlying assumption would have to be that activities are as likely to occur in areas closed to many recreational activities and with limited access (the estuary), as compared to public areas with convenient access (the bay). EPA presents no evidence to support this assumption. In fact, the evidence is all to the contrary. Common sense alone would indicate that exposure in areas of limited access and diminished recreational opportunity would occur less frequently, which is in fact acknowledged on page 2-10 of the risk assessment.

A sediment ingestion rate of 500 mg/day was selected for young children (ages 1-6) despite the fact that EPA Guidance (1989) recommends the use of 200 mg/day (page 2-26). Use of a sediment ingestion rate more than double EPA's own recommended rate is counter to EPA's Guidelines for Exposure Assessment's recommendation of realistic, not worst-case estimates. No site-specific criteria are presented to justify the use of the larger number, except for the statement that 500 mg/day would be a conservative estimate of exposure (page 2-26). The scenario for ingestion of sediments is already unreasonably conservative, because of the implausibility of young children contacting sediments at non-beach locations. The unwarranted use of additional uncertainty factors is not justified.

For inadvertent ingestion of sediments by older children and adults, default assumptions are available. The MDEQE (1989) and LaGoy (1987) recommend a value of 50 mg/event, and Clausing et al. (1987) recommends a value of 10 mg/event. EPA Guidance (1989) recommends 100 mg/event, but this value for older children and adults appears unnecessarily conservative. It is similar to ingestion values for young children reported by EPA Guidance (1989) even though young children are commonly believed to show a greater propensity for inadvertent soil ingestion than are older children and adults. Soil ingestion ranges of 10 to 50 mg/event would be appropriate for older children and adults because of the nonresidential character of the exposure points.

The body weight for a child 0-5 years of age should be 14 kg, not 10 kg, based on EPA Guidance (1985) which was referenced as the source in the risk assessment. The average of the 50th percentile body weights for male and female children (as recommended by EPA in 1989) can be obtained from Tables 2-3 and 2-4 in EPA Guidance (1985), and the resulting value is 14 kg. This method was apparently used (the risk assessment is not clear on this point) to derive the cited 40 kg body weight for children 6-16 years of age. Also, the body weight and skin surface figures are inconsistent. If the body weight used is 10 kg, the body surface figure used by Ebasco, 6880 cm^2, is too high. The 10 kg body weight represents less than the 10th percentile of 2-3 year old children; the 6880 cm^2 surface area represents the upper 50th percentile of children a year older. The result of minimizing body weight and maximizing skin surface area is an exaggerated estimate of the dermal dose of PCBs in children.

The amount of soil or sediment clinging to skin per day is known as the deposition rate. With only a substantive notation that sediments might adhere to skin more than soils, Ebasco chose an upper range value 3 times higher (1.5 mg/cm^2)

than the EPA's conventionally acceptable default value (0.5 mg/cm^2), which is supposed to be applied in lieu of more adequate information. Without more adequate information, there is no valid basis for assuming a greater deposition rate, and it is equally likely that wading in sediments may result in less adherence, due to the higher water content of sediments in the tidal area.

3.3.4.2 Ingestion of Biota

Source of Seafood

The assumption is made that all seafood in the diet originates exclusively from selected contaminated areas. In addition, it is also assumed that an individual species (flounder, clam, or lobster) comprises 100% of the seafood consumed (pages 2-29, 4-20). It may be reasonable to assume that a large percentage of self-caught seafood comes from a productive fishing area (EPA 1989), particularly Buzzards Bay, but it is implausible to assume that all seafood in the diet could come from the estuary or upper harbor regions.

It is unlikely that recreational or subsistence fisherman would conduct all of their fishing in the closed areas. Fishing conducted in the closed areas would have to be undertaken surreptitiously and would thus be secondary to other, more productive fishing locations, such as the bay. It could be conservatively assumed that seafood illegally caught in the closed areas (estuary and harbor) would comprise about one-third of the total seafood diet of recreational or subsistence fisherman.

During recent site visits by representatives of defendants, no fishing was observed in the estuary or upper harbor. Use of setlines and unmarked lobster pots would allow inconspicuous harvesting of seafood in the estuary and upper harbor, however. Individuals were observed fishing in the closed areas, but the activity was exclusively in the lower harbor, near or on the hurricane barrier. As a result, it could be conservatively expected that fish caught in the estuary would comprise less than one-quarter of the portion of dietary seafood illegally caught in the closed areas, or less than 10% (0.33 x 0.25) of the total seafood diet.

No evidence was presented in the risk assessment to support the contention that an individual could or would reasonably catch all of their dietary seafood from the estuary or upper harbor. In the absence of a supporting discussion, the EPA should have used a dietary mixing factor (EPA 1989) to account for a reasonable portion of the seafood diet that would be expected to be acquired in the estuary or upper harbor.

Ingestion Rate

The risk assessment has an upperbound estimate of seafood consumption of 227 grams/day for 10 years. This consumption rate is considerably higher than the 95th percentile worst-case estimate of 140 grams/day recommended by EPA (1989) or the 99.9th percentile ingestion of 165 grams/day used for Quincy Bay (EPA 1988).

As discussed in the Greater New Bedford Health Effects Study, only about 15% of the local population reported eating seafood two or more times per week. Thus, average consumption could reasonably be estimated to be about one meal per week. Assuming that a single serving of seafood is about 114 g (PTI 1987), average consumption could be about 20 g/day, which is also the default value recommended by MDEQE (1989). EPA (1989) presents average seafood consumption rates of 6.5 to 37 g/day. The risk assessment used a typical consumption rate of one 227 gram meal of fish per week, equivalent to a daily rate of 32 grams/day.

Consumption of Multiple Species

It is also unreasonable to assume that one species, particularly lobster, could comprise 100% of an individual's seafood consumption, up to one-half pound of edible flesh per day for 10 years. This rate of consumption is equivalent to about 2 or 3 whole lobsters per day. It would be more plausible to assume a representative mixed diet of seafood, as was performed for Quincy Bay (EPA Guidance 1988).

Consumption of local clams is also assessed unreasonably. In theory, only "master diggers" are legally permitted to harvest clams. The clams must then go through the state's shellfish depuration plant prior to distribution, where they are mixed with clams from other locations. Individuals can hold "bait licenses" for clams, and perhaps keep the clams for personal consumption. In regard to the estuary area, it seems implausible that clam harvesters would return to the same location 5 days each week for 10 years to catch clams. It is doubtful that the softshell clam population at the mudflats would support such extensive harvesting.

3.3.4.3 Inhalation of Ambient Air

The risk assessment assumes that individuals could be exposed continuously to the air in their homes for 8 to 24 hours each day for up to 10 years. The 24-hour assumption is extremely implausible, as individuals are not likely to spend all of every day at their residence. It would have been reasonable to incorporate a factor that would account for the number of hours and percentage of days in a year that individuals are likely to spend at their residences (EPA 1988). In addition, EPA has recommended 9 years as the average (50% percentile) length of residence.

3.3.5 Toxicokinetic Factors

The risk assessment states on page 2-24 that "The toxicokinetic factor ... adjusts for the differences in absorption between the ... absorbed dose received from exposure ... at the site, and the administered dose of the laboratory test from which the cancer potency factor or reference dose was derived. This adjustment allows quantitative dose-response data from animal studies to be applied to human exposure doses." In fact, the toxicokinetic factors as used in the risk assessment do nothing of the kind. These factors permit extrapolation between routes of exposure; i.e., if an animal bioassay used the oral route of exposure, application of an appropriate toxicokinetic factor may permit extrapolation to the dermal route of exposure. No evaluation of interspecies differences is provided, however, so extrapolation from animal studies to human exposure at the site is not considered. The implicit assumption is that human and animal absorption factors are identical, which is neither discussed nor supported in the document.

In addition, the risk assessment averages dermal absorption rates across four species and thus disregards the fact that its own cited sources show wide variations in dermal absorption between different species. Surface area conversions between species lead to risk estimates that are overstated 8.5-12 fold. In performing this scientifically unsupportable averaging, Ebasco also miscalculates the average and thus arrives at a higher dermal absorption rate, and consequently higher risk, than Ebasco's own figures support.

3.3.5.1 Dermal Absorption

The discussion of the Shah et al. (1981) study on page B-5 is seriously flawed. Dermal absorption in this study was reported to plateau after approximately one hour and it is concluded that "[t]he absorption observed by Wester, et al. (1983) over 24 hours was probably virtually complete after 1-2 hours." When a rate of absorption reaches a plateau it means only that the rate reached a plateau, not the total amount absorbed. For example, Shu et al. (1988) contradicts this, showing that in rats treated dermally with soil-bound 2,3,7,8-TCDD, dermal penetration following 4 hours of contact with skin was approximately 60% of that following 24 hours of contact (indicating that a plateau in the rate of absorption occurred), whereas the extent of absorption after 24 hours was approximately 1% of the administered dose. No conclusion whatsoever can be made about the Wester et al. (1983) study on the basis of the Shah et al. (1981) study.

The risk assessment uses the assumption that PCBs are expected to be dermally absorbed from soil in a manner similar to that of 2,3,7,8-TCDD because no studies of the absorption of PCBs from soil were available (Appendix B). An absorption factor of 5 percent of the applied dose was used to evaluate dermal absorption of PCBs from sediments. Poiger and Schlatter (1980) measured dermal absorption of 2,3,7,8-TCDD from soil applied to rat skin to be 0.05 to 2.2% of the applied dose (recalculated as 0.07 to 3% by EPA 1984a). Shu et al. (1988) measured dermal absorption of TCDD in soil applied to the skin of rats that was 1 percent of the applied dose. Measurements of dermal absorption obtained from rat skin are likely to overestimate human exposure, however. The skin of the rat is highly permeable when compared to human skin (Wester and Maibach 1980, EPA 1984). For example, the dermal absorption of hexachlorophene, a compound structurally similar to PCBs, was reported to be 76% of the applied dose in rats (Chow et al. 1978) and only 3% in humans (Feldmann and Maibach 1970).

The dermal absorption of PCBs in sediments thus does not appear to be plausibly estimated in the risk assessment. EPA (1988) used a dermal absorption factor of 0.5 percent of the applied dose for TCDD, an order of magnitude less than the value of 5 percent used in the risk assessment.

3.4 Toxicity Assessment

3.4.1 Validity of PCB Cancer Potency Estimate

The cancer potency value that EPA uses to estimate potential human cancer risk associated PCB exposure was obtained using the multistage model. Scientifically, it is inappropriate to use the linearized multistage procedures to estimate the cancer potency of PCBs. (Anderson, et al., 1983.) This model presumes carcinogenesis is a nonthreshold event, a theory that is increasingly repudiated by the literature. This model has been re-evaluated at the request of EPA by the person who devised it, and among the conclusions of this two-year study (Allen, et al., 1987) are that the EPA Cancer Potency Factor of 7.7 mg/kg/day^{-1} should be closer to 0.61 mg/kg/day^{-1}, and that EPA's use of the former CPF, in combination with other scientifically invalid methodologies, i.e., surface area conversions between species, overstate risk 12 fold. Use of the 0.61 mg/kg/ day^{-1} figure in this risk assessment would, taken alone, lower the estimated risk 12.6 fold. A more supportable alternative is the two-stage model proposed by Moolgavkar and Knudson (1981), which can incorporate information on the mechanisms of action of both tumor initiators and tumor promoters. This model uses information on the rates of increased cell proliferation as the basis for calculating a cancer risk; in the case of PCBs, the model would be based on the assumption that increased rates of hepatocellular proliferation are associated with increased hepatic cancer risk.

3.4.2 Statistical Variability of Cancer Potency Estimate

There is a great deal of uncertainty associated with a cancer potency estimate based on a single data point in addition to controls. As Figure 3.1 shows, the degree of curvature is unknown in such a situation and can vary significantly, affecting the slope at low doses and therefore the estimate of potency by many orders of magnitude.

The current cancer potency estimate for PCBs is based on the study of Norback and Weltman (1985) in which Sprague-Dawley rats received a diet containing 100 ppm Aroclor 1260 for 16 months, 50 ppm for 8 months, and a control diet for 5 months. Partial hepatectomies were performed on 24/70 animals of each sex at different times during treatment to evaluate concurrent hepatic morphology. Hepatocellular carcinoma or neoplastic nodules were observed in 45/47 female rats and in 1/49 controls; these values were used by EPA to estimate a cancer potency value for PCBs (EPA 1989). The extensive uncertainty associated with an estimate such as this, based on so little data, should be quantified and emphasized.

The study does not address the issue of animals that died prior to the 18 month interval. As nodules were included by the USEPA in its assessment, and because nodules were clearly present at 12 months, the correct procedure would be to include all animals that lived at least 12 months. This was not done. Since which animals were excluded is unknown, one can only guess at the actual incidence; but since 70 animals were initially started on PCB treatment, the actual risk estimate may be as low as 45/70 (not 45/47) and the cancer potency estimate would be closer to 2.0 mg/kg/day[1].

The "Materials and Methods" section of the Norback and Weltman (1985) study is deficient in a number of areas, such as: no rationale for dosage selection or dosage variation; no rationale for including animals undergoing partial hepatectomy; no verification of chemical analysis, stability or purity; no measurement of PCDF content; a lack of pathology protocol on organs besides the liver; and failure to state methods used to prevent cross contamination of materials (in an earlier summary of this study certain PCB isomers were allegedly being tested as well).

An additional source of uncertainty in the potency estimate is related to partial hepatectomy. About one-third of the animals used in the Norback and Weltman (1985) study underwent partial hepatectomies, which results in extensive hepatocellular proliferation and is a standard procedure used to promote liver tumors. This procedure undoubtedly increased the liver tumor rate in the treated group, adding further to the uncertainty associated with the potency estimate by artificially inflating it, leading to overestimation of PCB-induced cancer risk.

3.4.3 Toxicological Heterogeneity among PCB Mixtures

EPA (1989) states, "Although it is known that PCB congeners vary greatly as to their potency biological effects, for purposes of ... carcinogenicity assessment Aroclor 1260 is intended to be representative of all PCB mixtures." There is no scientific support for this generalization. In fact, the evidence indicates that carcinogenic potency generally decreases with decreasing chlorination (Schaeffer, et al. 1984, Kimbrough 1987).

Aroclors of chlorination less than Aroclor 1260 have not been found to be carcinogenic. Thus, using Aroclor 1260 as a surrogate for the potency of every other PCB mixture will greatly overestimate risk. Recognizing the variation in potency among environmental PCB mixtures is important in order to accurately characterize their carcinogenic risk.

3.5 Risk Characterization

The risk characterization section of the risk assessment contains repeated examples of language that implies a great deal of certainty with regard to calculations of risk and that fails to reflect the extreme uncertainty associated with the process. For example, on page 4-3 the statement is made that "... a 2 x 10^{-6} incremental risk level implies that an individual's probability of manifesting cancer from the exposure assessed is two in one million." In fact, what the notation 2 x 10^{-6} incremental risk means is that a statistical upper bound on potential risk has been estimated to be 2 in one million under a variety of conservative assumptions, and that actual risk is likely to be much less. Page 3-2 incorrectly states that "The risk value obtained represents increased carcinogenic risk over a person's lifetime from exposure to a particular chemical"; actually, it represents a statistical upper bound on potential increased risk. Misleading language like this does a disservice to public understanding of risk and reveals the lack of either sophistication or candor of its authors.

3.5.1 Hazard Index

There are two problems with the way the hazard index was calculated in the risk assessment. These are:

- The end points of toxicity of the chemicals of concern are dissimilar and their criteria should therefore not be combined.
- Inappropriate criteria were used.

This section describes each of these problems in turn. They are summarized in Table 3.1. A summary table similar to Table 5.1 would have clarified the risk assessment enormously. It was very difficult to find discussions of the toxicity value choices that did not contradict each other and there was no discussion at all of the toxicological bases for the criteria selected.

3.5.1.1 Dissimilar End Points of Toxicity

EPA's Superfund Public Health Evaluation Manual (EPA 1986a) provides guidance for the estimation of noncarcinogenic effects at a site where multiple chemicals are present and states that, " ... the assumption of additivity reflected in the hazard index equation is most properly applied to compounds that induce the same effect by the same mechanisms. Consequently, application of the equation to a mixture of compounds that are not expected to induce the same type of effects could overestimate the potential for effects. **If the hazard index results in a value greater than unity, segregate the compounds in the mixture by critical effect and derive separate hazard indices for each effect**" (emphasis in original).

The risk assessment calculates a hazard index to estimate the likelihood of adverse noncarcinogenic effects by adding together the relative risks associated with lead, copper, cadmium, and PCBs to derive a total potential site risk. The statement is made on page 4-4 that hazard index values are calculated for exposure to the mixture "because these compounds have been shown to exert similar toxic effects". Similar statements are made on pages 4-7 and 4-26. Review of the bases for the criteria from which each of the toxicity values used to calculate the hazard indices were derived shows that the end points of toxicity of concern are very diverse indeed and in no way justify combination.

The hazard index for acute exposure was based on criteria for cadmium and PCBs. The criterion for cadmium is based on vomiting that occurred in humans following single doses (EPA 1980), while that for PCBs is based on a number of studies in rats and rabbits in which effects on reproductive, thyroid, and liver toxicity were evaluated (EPA 1986). These end points are not comparable.

The hazard indices for chronic exposure were based on criteria for cadmium, PCBs, copper, and lead. The criterion for cadmium is based on kidney damage after chronic human exposure (EPA 1984), that for PCBs on reproductive effects in monkeys (EPA 1988), and those for copper and lead on drinking water treatment technology, not toxicity (EPA 1988) (although acute gastric irritation and neurotoxicity, respectively, are the relevant end points). These end points are also not comparable.

Thus, the risk assessment fails to follow EPA guidance for performing risk assessments of noncancer effects by combining dissimilar end points of toxicity, substantially overestimating noncancer risk.

3.5.1.2 Inappropriate Criteria

Several of the criteria used to evaluate the hazard indices for noncancer effects were chosen inappropriately. The criterion for copper, for example, is based on its MCL. The copper MCL is based on drinking water treatment technology (EPA 1988). It is not correct to use an MCL based on drinking water treatment technology to evaluate the potential toxicity associated with ingestion of contaminated sediments or biota.

The risk assessment states on page 4-26 that "no appropriate standard or criteria values are available to assess acute exposures to ... copper" (similar statements are made on pages 4-14 and 4-18) and does not include copper in its acute hazard indices. While it is true that there are currently no appropriate criteria, an earlier copper MCL was based on reports of gastric irritation experienced by humans following short-term exposure to high doses; no longer-term effects of exposure have been predicted (EPA 1984; EPA 1987). This MCL is no longer in use, however, and has been replaced by that based on treatment technology. It is odd that the risk assessment would not calculate an acute hazard index for copper when the only adverse effects that have been noted for copper are acute, while using its MCL to calculate a chronic hazard index despite the lack of evidence of chronic effects and despite its irrelevance. Copper should not be included in the hazard index calculations since there are no relevant criteria and it is not considered toxic after chronic exposure to low doses.

The criterion for lead is based on its MCL. The MCL for lead is also based on drinking water technology (EPA 1988). An alternative value based on neurotoxicity following chronic exposure should be derived or lead should not be included in the hazard index calculation since there are no relevant criteria.

The criteria for PCBs are based on Health Advisories. The long-term Health Advisory for PCBs developed by the Office of Drinking Water was based on reproductive effects in monkeys (EPA 1988). The short-term Health Advisory developed by the Office of Health and Environmental Effects was based on a number of studies in rats and rabbits in which effects on reproductive, thyroid, and liver toxicity were evaluated (EPA 1986). These numbers have been withdrawn and are no longer in effect, however (EPA 1989).

3.5.2 Absence of Weight-of-Evidence Classification

EPA's Guidelines for Carcinogen Risk Assessment (1986) state that in the summary of a risk characterization, the final risk estimates "will be coupled with the EPA classification of the qualitative weight of evidence. For example, a lifetime individual risk of 2 x 10-4 [B2]. This bracketed designation of the qualitative weight of evidence should be included with all numerical risk estimates." The risk assessment does not provide the weight of evidence classification for PCBs, implying an unwarranted certainty on the part of the authors with regard to the likelihood of their human carcinogenic potential.

3.5.3 Inappropriate Use of Significant Figures

EPA's Guidelines for Carcinogen Risk Assessment (1986) state that in the summary of a risk characterization, "the final risk estimate will be generally rounded to one significant figure". The risk assessment uses three significant figures, incorrectly implying an accuracy in the estimates that is not possible.

3.5.4 High-Dose Nonlinearity

EPA's Superfund Public Health Evaluation Manual (1986) states that the relationship: Risk = CDI x Carcinogenic Potency Factor "is valid only at low risk levels. For sites where chemical intakes may be large (e.g., estimated carcinogenic risk above 0.01), an alternate model should be considered." The risk assessment has calculated a number of high risk estimates, but does not address the issue of nonlinearity at high doses. The issue is not discussed and no conclusions are presented.

3.5.5 Subchronic Cancer Risks

Estimating PCB-induced cancer risks based on only one or five years of exposure involves abundant uncertainty. In the Norback and Weltman (1985) study on which the cancer potency value is based, carcinomas did not appear until 100 weeks after treatment began and most appeared in animals sacrificed between weeks 114 and 119. Most of the tumors occurring in this study would not have been observed had the animals been sacrificed at 104 weeks, as it standard among NCI/NTP bioassays. The animals in this experiment were exposed to high doses of PCBs for 24 months, equivalent to at least 80 percent of a rat's natural lifespan. Examination of age-incidence relationships for human cancer indicates that most cancers are observed after age 60, indicating that exposure to environmental agents for most of an individual's lifetime may be required for tumor development. It is thus unlikely that human exposure to low doses of PCBs for five or nine years, the period used in the risk assessment to estimate carcinogenic risk to children, will lead to cancer.

3.5.6 Location-Specific Characterization of Chronic Risks

The risk assessment qualified exposure to sediments in Areas II and III as being based on conservative exposure conditions that were not considered plausible for these areas. The implausible conditions included long-term repetitive exposure to the maximum detected contaminant concentration (pages ES-9, 4-13, 4-18, 4-48).

Amazingly, similar qualifications were not expressed for potential exposures and risks estimated for Area I, despite identical assumptions of long-term repetitive exposures to the maximum detected concentrations using implausible exposure scenarios. Page 2-10 of the risk assessment concluded that recreational activities and exposures to sediments are least likely to occur in Area I. If the conservative nature of the exposure assumptions requires qualification of estimated risks posed by potential exposures to sediments in the lower harbor and bay area, it would appear that equal or greater uncertainty should be afforded to the risk estimates for the estuary.

As acknowledged by the risk assessment, exposure to sediments is least likely to occur in Area I (page 2-10). By failing to qualify the estimated risks for the estuary, it appears that the results of the risk assessment are being selectively polished.

3.5.7 Potential Cancer Risks Posed by Exposure to Sediments

A cancer potency value for Aroclor 1260 was used to characterize potential risks posed by exposure to sediments. As discussed earlier in Section 2.2, the congener analysis of PCB residues in seafood that was presented to justify the use of the potency factor for Aroclor 1260 is not applicable to sediments. The sediment residues have not been subjected to the same pharmacokinetic influences as the seafood residues. The extensive use of lower chlorinated Aroclors in the New Bedford manufacturing community makes the presence of less-chlorinated residues even more likely. Use of a cancer potency for Aroclor 1260 to characterize upper bound excess cancer risks posed by sediments is inappropriate.

3.5.8 Inconsistency of Risk Estimates with Scientific Observations

The potential upper bound lifetime cancer risks that the risk assessment has estimated to be associated with fish consumption in the New Bedford area in the 10^{-1} range (Tables 4-7 and 4-9), equivalent to 1 excess cancer case per 10 individuals. This risk level is high enough to be detected easily in exposed populations and yet has not been substantiated with epidemiological evidence of excess cancer risks among populations exposed occupationally to much higher PCB levels. For example, the retrospective cohort mortality study conducted by Brown (1986) examined the risk of cancer mortality associated with PCB exposure in two plants manufacturing electrical capacitors (including one in New Bedford). In these plants, exposures to PCBs ranged from 24 to 2,120 ug/m^3. No excess cancer deaths could be attributed to PCB exposure in this study.[5/]

Other evidence of the risk assessment's excessively overestimated risk comes from the Greater New Bedford Health Effects Study (GNBHES), which was conducted as a result of the concern about PCB contamination in New Bedford Harbor to determine the prevalence of elevated serum PCB levels in the Greater New Bedford population. CDC has estimated that 99% of unexposed persons in the U.S. have serum PCB levels less than 30 ppb; for the GNBHES, levels above 30 ppb were assumed to represent elevated levels. Of the 840 individuals examined, only 11 (1.3%) had levels above 30 ppb. On the basis of these results, a second study was conducted to evaluate the serum PCB levels of residents who were thought to be at high risk of exposure due to their relatively high levels of ingestion of seafood from contaminated areas. Of

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5/ It should be noted that Appendix D of the HSFS improperly cites an earlier survey of Brown without reference to Brown (1986).

the 110 participants in the second phase of the study, only 7 (6.4%) had serum PCB levels greater than 30 ppb. In the second phase of the survey, persons reporting employment in the manufacture of electrical machinery and supplies were more frequently found in the upper two quartiles of serum PCB concentrations. This observation could indicate that employment is a greater indicator of serum PCB levels than consumption of seafood. In view of the fact that the serum PCB levels of the New Bedford population are in agreement with that of the general U.S. population, even among the frequent fish eaters, such a high level of predicted excess cancer risk is implausible.

EPA's Guidelines for Cancer Risk Assessment (EPA 1986) state, " ... it is critical that the numerical estimates of risk not be allowed to stand alone, separated from the various assumptions and uncertainties upon which they are based". Only by virtue of their proximity are the risk manager and the nontechnical public afforded insight into the true magnitude of risk to public health, which can not be known with the degree of quantitative accuracy implied in the risk assessment of New Bedford Harbor.

Potential uncertainty was evaluated in Section 4.1.4 of the risk assessment. It was concluded that uncertainties in the estimates of chemical concentrations, exposure parameters, toxicity parameters, and potential risks could span several orders of magnitude. It is puzzling why this characterization of uncertainty is not adequately represented in other areas of the document, particularly in the Executive Summary, in the Risk Summary (Section 4.2.3), in Overall Site Risks (Section 4.3), and in the feasibility study.

Estimates of potential risks are presented in the risk assessment using language that implies a severe and present danger to public health. For example:

- "Based on this evaluation, exposure to lead and PCBs through the ingestion of biota presents a public health risk" (page ES-11).

- "Risk from direct contact and ingestion of contaminated shoreline sediment is greatest for Area I. Exposure to sediment ... resulted in risks for all age classes exceeding the target range of 10^{-4}. Risks were high even under probable exposure conditions...." (page 4-41).

The language used to communicate risk is as critical as the numerical estimates of risk. Missing from the risk assessment are reminders that estimated risks are based only on the assumed conditions of the possible exposure scenarios that apply only to a hypothetical population, not actual conditions of the local population. The exposures were evaluated using conservative conditions likely to greatly overestimate exposures of actual conditions of the local population.

Even Section 4.1.2, which explains how a risk assessment is performed, is misleading in its implication of certainty. For example, the statement is made that " ... a 2×10^{-6} incremental risk level implies that an individual's probability of manifesting cancer from the exposure assessed is two in one million." In fact, the risk level implies only that under certain conditions, the 95% statistical upper bound on potential risk is estimated to be 2×10^{-6} and that actual risk is likely to be much less.

Use of language like " ... the ingestion of biota presents a public health risk" also indicates a troubling mixing of risk assessment and risk management. Determination of what presents an unacceptable public health risk is dependent on a variety of social, economic, and political considerations, in addition to scientific characterizations of risk. Considerations of non-scientific determinants of "acceptable" risk are not included in EPA risk assessment policies that define upper bound, lifetime, excess cancer risks of 10^{-4} to 10^{-7} as the target risk range.

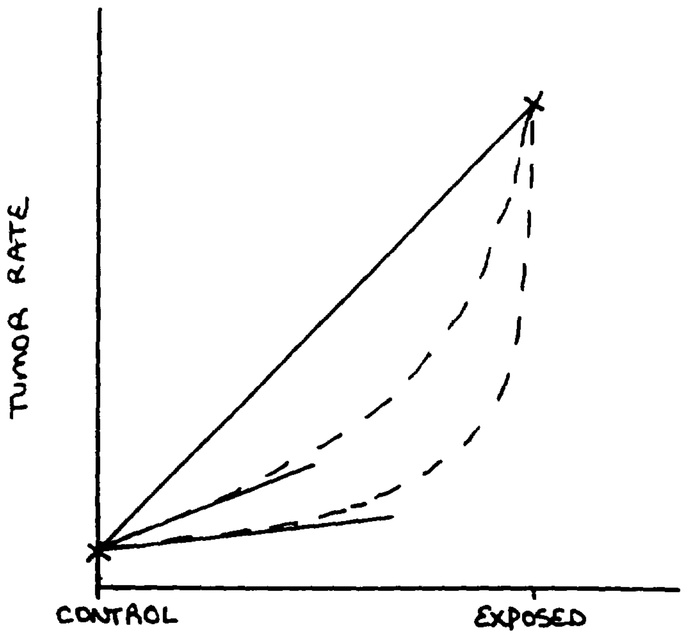
As discussed on page 2-41, the "results of this risk assessment are being used to determine the need for and evaluation of remedial actions rather than to determine or predict actual health effects." Thus, statements such as "This risk assessment presents and quantifies risks to public health due to PCB, cadmium, copper, and lead exposure in the New Bedford Harbor area under baseline (existing) conditions" (page 1-3) are inappropriate and inconsistent. It is difficult enough to communicate the results of complex risk assessments to a nontechnical audience. Providing unqualified judgments regarding threats to public health not only complicates the task of risk communication, but also does a grave disservice to the public that EPA is supposed to serve.

TABLE 3-1

Basis of Values Used In Risk Assessment to Evaluate Noncarcinogenic Effects

Chemical	Short Term	Chronic	Comments
Cadmium	10-day HA (human vomiting)	RfD (human kidney damage)	
Copper	not evaluated	MCLG (drinking water treatment technology)	1. No evidence for chronic effects 2. Not end point of toxicity
PCBs	10-day HA (reproductive, thyroid, and liver toxicity in rats and rabbits)	longer-term HA (reproductive effects in monkeys)	1. Numbers withdrawn and no longer considered valid
Lead	not evaluated	MCL (drinking water treatment technology)	1. Not end point of toxicity

FIGURE 3-1



4.0 COMMENTS ON DATA GAPS UNDERLYING THE HSFS

Despite numerous formal and informal requests, several important pieces of information and sets of data that were collected as part of the HSFS have not been made available to the defendants or the public.[1]

In order to evaluate a data set, an analyst needs sample collection technique, chain of custody, laboratory analytical method, laboratory quality control, and sample event quality control documentation in order to critically evaluate the quality of the data and to determine the actual analytical results. Simple listings of concentrations computed by laboratory analysts alone are not sufficient to analyze and interpret a data set. When EPA fails to make data of this type available in a timely and comprehensive fashion, it effectively precludes a meaningful opportunity to comment. (For a further discussion of analytical quality assurance/quality control data, see, United States v. AVX, Requests for Admission Concerning Sampling and Responses, specifically incorporated herein by reference, in which the validity of the government sampling is questioned).

Specific data gaps that we have identified are as follows, but other examples are described in the various other comments filed today.

1. Baseline Environmental Risk Assessment. The HSFS

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[1] The Ebasco Monthly Progress Reports for 1988 and 1989, until they were discontinued, cite the reports and/or data collections referred to below.

specifically references a baseline risk assessment (HSFS, p. 3-1, 3-10 to 3-14). Although the HSFS states that the environmental risk assessment "is scheduled for completion in the summer of 1989" (HSFS at 3-1), the document has not yet been released. Although EPA subsequently stated in Charles Bering's letter dated September 19, 1989 that EPA does not intend to rely on the document, nonetheless, in view of the explicit reference in the draft HSFS, the defendants are entitled to review the environmental risk assessment. Without this document, defendants are unable to examine a critical piece in EPA's purported justification for dredging the hot spot. At the very least, until EPA shares the environmental risk assessment with the public and the defendants, EPA should eliminate any reference to environmental hazard in the HSFS.

2. Sediment Quality Data. Over several months, defendants have attempted to procure the full laboratory database utilized to define the "hot spot".[2] In particular, defendants requested the 1988 Corps of Engineers' data. To date, as these comments are being submitted, the data have still not been made available and have not been placed in the Administrative Record. An

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[2] While defendants believe they needed an additional extension in the comment period in order to review such information and provide comprehensive and responsive comments on the HSFS, such an extension was not requested due to the EPA's statement that the extension to October 16, 1989 would be the final extension. See, defendants' requests for extension dated August 14 and September 15 (which addresses this precise issue in detail) and EPA's response in letters to counsel from Merrill Hohman dated September 21, 1989 and Charles Bering dated September 19, 1989.

extremely lengthy process of deciding how EPA would provide such data to the defendants has been developed by the Agency. As a result, defendants will not receive the data they have consistently requested for many months until after the close of the comment period. The fact that this data is not readily available and in the Administrative Record or even in the New Bedford Harbor Sites File, makes it abundantly clear that EPA could not have used the data to define the "hot spot." Further, the remedial action appears to be based on unvalidated data, since no validation reports are in the Administrative Record. This is a clear example of hasty, arbitrary action in developing a remedial action strategy.

3. Air Quality Data. Only very limited air quality data collected during the pilot dredging program have been made available.[3] In addition, EPA's consultants have informed the defendants' representatives that EPA has not validated that data and will not validate it or complete a report on the air quality results until after the comment period expires (personal communication, R. Hughto with A. Fowler 10/2/89). Nonetheless, EPA's conclusions about the safety of dredging are based on the lack of risk from volatilization of PCBs during dredging. EPA has now admitted that it has no basis for that conclusion. Further, because EPA apparently believes PCBs may be toxic, EPA

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[3] Portions of the data have been shown to representatives of the defendants; however, it is partial data which is meaningless without the remainder of the data set. See, e.g., Memorandum from R.J. Rossi to R. Hughto dated October 2, 1989.

should be concerned about volatilization during dredging operations[4] and should address the likelihood that volatilization will be enhanced during warm summer dredging. EPA has acted arbitrarily and in derogation of its duty to analyze public health risks by failing to undertake the air analysis as part of the HSFS in a timely fashion.

4. Toxicity Data. EPA conducted toxicity data evaluations on biota during the course of the pilot dredging program. Defendants were not provided with the results of these analyses.[5] Detailed descriptions of the methodologies for the tests and the results of explanations for impacts on biota have not been provided. This information is vital to the evaluation of the impacts of dredging on the biota in the Harbor as a result of any dredging project. In the 1987 work plan for the pilot dredging program, the Corps stated that the data was important to evaluate dredging effectiveness and water quality impacts. (U.S. Army Corps of Engineers, New England Division, "Pilot Study of Dredging and Dredged Material Disposal Alternatives, Superfund Site, New Bedford Harbor, Massachusetts, September, 1987.)

5. CDF Stability Data. The Pilot Dredging Program work plan called for the collection of data on the stability of the

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[4] See Thibodeaux, L.J., "Theoretical Models for Evaluation of Volatile Emissions to Air During Dredged Material Disposal with Application to New Bedford Harbor, Massachusetts," prepared for U.S. EPA Region 1, Contract No. DACW 39-87-M-2487, May 1989.

[5] Only references to the results in the pilot dredging study final report and some incomplete data have been reviewed.

CDF since its construction. None of the data have been provided, despite requests for such data. We believe that such information is important in the evaluation of the stability of the CDF, particularly as it relates to its use in the overall remedial action scheme.

6. Pilot Dredging Operational Data. Neither the pilot dredging report nor the Administrative Record includes operational data or daily logs compiled during the course of the pilot dredging program. Defendants believe that such information is crucial to the overall evaluation of dredging as a remedial action.

The defendants requested permission to monitor the dredging with their own personnel and were refused by EPA prior to the pilot dredging program, despite the fact that the defendants were willing to be responsible for their own personnel. As a result, no information on operational aspects of the pilot dredging program has been made available to the public. Such information is necessary to understand the operations of the dredges during the pilot dredging program and the potential extrapolation of the pilot dredging study results to the "hot spot" area which EPA now claims is appropriate. The exclusion of such information from the Administrative Record does not permit an evaluation of EPA actions or the basis for its decision.

7. Decision Criteria Meeting Results. The decision criteria for the pilot dredging program called for meetings of specific staff to review results and decide whether to proceed

with the program if decision criteria were exceeded. The government has admitted that violations of such criteria took place; however, the minutes of meetings of the criteria committee and decisions made by the committee are not available to the public. The failure to inform the public of the basis for decisions by the government to continue with the dredging program after exceedances of decision criteria, in derogation of the Agency's stated policy, was improper.

Defendants submit that a proper feasibility study could not have been completed in compliance with EPA's guidance for feasibility studies without utilizing the above data. Its absence from the Administrative Record indicates that the Agency's decisionmaking was arbitrary and capricious.

5.0 COMMENTS ON DREDGING

5.1 GENERAL

5.1.1 PILOT DREDGING PROGRAM HISTORY

Pursuant to comments EPA received concerning the 1984 New Bedford Harbor Feasibility Study, EPA contracted the ACOE to perform an Engineering Feasibility Study (EFS) to evaluate dredging and dredge material disposal alternatives for the PCB-contaminated sediments in the Acushnet River Estuary. The EFS was conducted by the ACOE Waterways Experiment Station (WES) and the results are contained in a series of 12 technical reports (WES TR EL-88-15). To support the EFS, the ACOE conducted a pilot dredging program (PDP) within a protected cove located approximately 2,000 feet north of the Coggeshall Street Bridge.

The ACOE prepared a proposal for the PDP in November 1987 entitled "Pilot Study of Dredging and Dredged Material Disposal Alternatives, Superfund Site, New Bedford Harbor, Massachusetts."

The proposal outlined the use of three different dredges, two dredge disposal alternatives and an environmental monitoring program to be conducted simultaneously with the PDP. The

ACOE maintained that the PDP was necessary to provide supporting data to the EFS laboratory studies, literature reviews and desk top analyses. The two questions that the PDP was to address, according to the ACOE, were: 1) what are the contaminant release rates from dredged material disposal alternatives?; and 2) what are the contaminant release rates for dredging alternatives? The ACOE claimed that the EFS, including the PDP, was critical to EPA's Record of Decision (ROD) for New Bedford Harbor, and that "a pilot study will reduce the uncertainty ... in the final design and will allow smoother transition from alternative selection to final design and hence to construction."

The ACOE proposal raised serious questions relative to the suitability of the proposed study to serve as a demonstration and pilot program for dredging of contaminated sediments from New Bedford Harbor. The PRPs submitted comments on the proposal (Aerovox, et al. 1988) identifying some of the key issues and reasons why the proposed study would not serve as a suitable pilot study, particularly to apply to dredging of the "hot spot."

The government ignored those comments and, after stating that it was not their objective to extrapolate the results to the "hot spot" area (2/18/88 meeting of government attorneys, representatives of EPA and the Corps, and the defendants),[1] have nonetheless taken the results to apply to the analysis of dredging to the "hot spot."

PDP siting activities began in the fall of 1986 and geotechnical analysis of estuary sediments relative to their suitability for the construction of a confined disposal facility (CDF) was performed in 1987. Baseline environmental monitoring of the water quality in the Acushnet River Estuary and the sediments in the PDP area began on July 9, 1987 and was completed on June 23, 1988. A total of nine days of monitoring was conducted.

CDF construction was initiated on May 5, 1988 and was determined to be nearly complete by November 1988.

PDP dredging operations began on November 21, 1988 with contaminated sediments from Dredge Area No. 1 being placed in the CDF using the Cutterhead Dredge. Dredging of contaminated sediments from Area No.1 using all three dredges was completed on December 13, 1988 and all dredge spoils were

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[1] See also attachment to memorandum of November 13, 1986 from Frank Ciaviattieri re: Proposed Pilot Study Meeting Minutes (attached) from the sites file. ("The decision to work in areas of lower contamination in the upper estuary ... is based on minimizing the risk of release. ... Contaminate [sic] release testing should be completed during the study design period. ... If the tests show minimal release we will incorporate dredging higher contaminated material as a second step in the plan.")

placed in the CDF. Dredging of the Contained Aquatic Disposal (CAD) cell began on December 20, 1988 using the Cutterhead Dredge. Sediments dredged for the CAD construction were discharged to the CDF and were used as cover/capping material for the contaminated sediments already deposited in the CDF. Construction of the CDF (begun in May 1988) was completed on January 4, 1989.

CAD filling with contaminated sediment began on January 7, 1989 and it continued until January 20, 1989. CAD capping with clean sediments followed, and these activities were completed on February 11, 1989. Environmental monitoring of the water quality in the Acushnet Estuary and from the CDF discharge was performed by EPA and Rizzo Associates (on behalf of the defendants) during the November 1988 - January 1989 dredging operations.

The ACOE released an Interim Report on the PDP in June 1989 entitled "New Bedford Harbor Superfund Pilot Study: Evaluation of Dredging and Dredged Materials Disposal" (Report). The Report presented some of the results of the PDP and recommended a specific dredge and dredge disposal alternative to be used as a remedial action in New Bedford Harbor, should dredging be the selected remedy. However, the PDP was not conducted in an area similar to, or representative of, the "hot spot" area. The Acushnet River

Estuary currents, PCB concentrations and PCB-oil contaminant release rates and other results cannot be extrapolated to the "hot spot" area. The PDP was an exercise in the evaluation of dredging equipment and its mechanics rather than a field study to support the feasibility of dredging in the "hot spot" areas.

In the Pilot Study Report on page 4, it states that the following technical objectives were achieved and/or evaluated:

a. Evaluated the effectiveness of the dredging equipment in removing PCB contaminated sediment from New Bedford Harbor.

b. Evaluated actual sediment resuspension and contaminant release under field conditions for the selected dredging equipment, operational controls and turbidity containment techniques.

c. Refined and scaled-up laboratory data for design of disposal and treatment processes for contaminated dredged material from this field site.

d. Developed and field tested procedures for construction of contained aquatic disposal cells for contaminated dredged material under site-specific conditions.

e. Established actual cost data for dredging and disposal of New Bedford Harbor sediment.

5.1.2 PILOT PROGRAM SCOPE OF WORK

The Pilot Study was conducted in an isolated cove adjacent to the Acushnet River in an area of limited PCB sediment contamination. As part of the Pilot Study an in-water dike was constructed to create a confined disposal facility (CDF).

Dredging was conducted with three different types of dredge: the matchbox, the mudcat, and the cutterhead. The Corps has recommended that the cutterhead be utilized for any dredging on a larger scale in New Bedford Harbor. The project included the dredging of contaminated sediments and the testing of disposal of contaminated sediments in a CDF and in a CAD. The CAD is a capped underwater area for the disposal of contaminated sediment.

The Corps conducted environmental monitoring, including physical, chemical, and biological evaluations of the sediments, harbor water, effluent from the CDF, and air quality during the pilot project. The Corps also evaluated operational and physical controls of the dredging equipment during the course of the Pilot Study.

Four major objectives were stated for the operational phase of the dredging program:

- o to minimize the amount of sediment resuspension associated with the dredging operation;
- o to minimize the total amount of sediment removed while maximizing the removal of contaminated sediment;
- o to develop and refine the optimum operational characteristics to achieve the first two objectives while still maintaining effective production rates; and
- o to develop and refine operating procedures to minimize the operating and support personnel's exposure to contaminants.

It is important to note that these objectives are stated in terms of design criteria rather than evaluation of criteria for the dredging alternative. This statement of objectives indicates that the selection of dredging is a foregone conclusion and that no evaluation of the technology or the environmental impacts of the implementation were being undertaken. Minimizing resuspension and refining operational characteristics and procedures are design functions that are well beyond the evaluation of a technology. The study was conducted as a design study and not as a method of evaluating dredging as an applicable remedial action alternative for the site.

Based on the results of implementing the Pilot Study, the Corps determined that "the use of a hydraulic dredge is both practical and effective method for removing contaminated sediments for New Bedford Harbor."

5.2 PILOT STUDY APPLICABILITY TO THE "HOT SPOT"

The location selected for the pilot dredging program raises significant questions relative to the validity of the information collected when compared to the overall objectives of the program and the applicability of the data to evaluating alternatives for remedial action in New Bedford Harbor, particularly in the "hot spot." The site of the pilot program is totally unrepresentative of the "hot spot" area and other contaminated areas of the Harbor. Concentrations of PCBs in samples taken from the pilot study area ranged from non-detectable to 585 ppm.

A properly designed pilot study to be extrapolated to the "hot spot" would have included additional testing of the dredging in a more highly contaminated area that more closely resembles the "hot spot" and that would provide additional data for an area different from the cove area. Although this approach was recommended by some government representatives, it was not followed. Yet it would have provided information relative to the dynamics of contaminant resuspension from areas other than the cove to determine whether those dynamics are different from a more highly contaminated area. A more extensive database on which to base the design of the remedial action program for the "hot spot" would have been developed.

A project designed to dredge and store PCBs with concentrations below 585 ppm cannot be characterized as representative of "hot spot" dredging, where concentrations are allegedly as high as 10,000 ppm or more. One of the basic principles of the behavior of PCBs in the environment, and how they partition between environmental media, is that PCB behavior, to a greater or lesser extent, relates directly to PCB concentration. PCB partitioning, for instance, can be heavily dependent upon concentration gradients for virtually all potential chemical and physical transformations of PCBs in the environment; e.g., volatilization, solubilization, adsorption, and diffusion (Thibodeaux, L., Chemodynamics, John Wiley and Sons, NY 1979).

In addition, while PCBs at the average level of 33 ppm will in all probability be adsorbed onto fine (i.e., clay and silt) particles, PCBs at higher concentrations (as are reported to exist in the "hot spot") have a higher probability of being in an oily or a non-aqueous phase liquid (NAPL). The NAPL phase is neither dissolved nor associated with suspended sediments so that PCB behavior can substantially differ from what is found in an adsorbed or dissolved stage. In fact, numerous investigators have observed oily phases surfacing in the Acushnet River while working in the "hot spot" area.

PCBs in sediments containing low levels of oils (including the PCBs themselves), therefore, may behave differently from PCBs in an adsorbed or dissolved stage. An associated release of NAPL from oily sediments upon dredging would not be modeled or represented adequately by consideration of suspended sediment alone and extrapolating from turbidity and suspended solids observations. However, the USACE has indicated that it has assumed that in sediments with 100 ppm PCBs, the PCBs will be transported primarily with suspended sediments. This may not be the case if sediments contain higher PCB concentrations and high levels of petroleum hydrocarbons.

The potential presence of NAPL in more highly contaminated sediments means that the results of the pilot study performed in lightly contaminated sediments are not representative of conditions that would be encountered when dredging more contaminated areas. The sampling conducted was not adequate to assess NAPL release and transport under non-pilot conditions. In fact, this phenomenon appears to have been ignored by the government in their reports. It is a fundamental deficiency in design to have conducted a study in an area where PCB concentrations are not representative of the "hot spot" and to subsequently attempt to force the results to apply to the "hot spot" area, despite the existence of very different physical conditions. EPA originally stated (2/18/88 meeting) that the pilot study results would not be extrapolated to the "hot spot" but ultimately did such an extrapolation to justify the selection of the dredging alternatives. EPA, in an attachment to a memo dated November 13, 1986, recommended that pilot testing of dredging begin in areas of lower contamination, but that testing in areas of higher contamination be conducted as a second step. Additional testing of dredging in the more highly contaminated areas was recommended. The government, again, did not implement the recommendations of its own work in its haste to justify the dredging remedial action.

A separate and distinct question raised by the choice of pilot location is whether dredging in the cove, with its low currents, would be representative of more dynamic conditions in other portions of the upper estuary. In fact, consideration of the hydrodynamics of the upper estuary seems to be singularly lacking in the study, either as they exist now or as they might be changed by dredging itself. The currents are much stronger in the upper estuary than in the pilot area and the assumptions made relative to sediment plume movement based on the observations in the cove, without consideration of the difference in hydrodynamics, are inappropriate. The Pilot Study and the HSFS do not take into account changes in tidal hydraulics which would be caused as dredging -- pilot or remedial -- would itself alter the bottom contours, since both the pilot and any large-scale dredging would change the harbor topography as sediments were removed. Results from the pilot study would have to be evaluated conservatively and would have to include estimates on variability in tidal hydraulics due to dredging and its effects on chemodynamics and release of PCB.

5.3 ENVIRONMENTAL MONITORING PROGRAM

5.3.1 GENERAL

Environmental samples were collected by the government in several media: sediment, water, CDF effluent, and air. In addition, toxicity testing of indicator organisms was also conducted. The complete toxicity test results and the air monitoring data have not been provided to us to date. In addition, much of the sediment, water, and CDF effluent data have not been provided either. This is a serious deficiency in attempting to evaluate the results of the program, particularly when extrapolation to the "hot spot" is required based on the limited database that was developed. It appears that much of the data were not available to EPA when the evaluation of alternatives was conducted, but the program was pushed forward without the data.

Several data sources cited in the report, in addition to the air quality and toxicity data, are not provided making it impossible to review or evaluate those results or statements made based on those results. These include the following:

- background sediment quality data in the dredging areas

- sediment quality data collected after dredging

- water column data such as those presented on page 24 for which a full description of collection conditions and analyses methods are necessary to understand the data and the reasons why there does not appear to be a mass balance

- data bases for showing "considerable reduction from the contaminant levels dredged at" as referenced on page 24

Since we do not have the data, we cannot evaluate the conclusions or attempt to understand the basis for statements or the adequacy of those statements.

The "hot spot" dredging and treatment program proposed would result in significant potential for volatilization of PCB during the dredging and at several points during the treatment process. The air monitoring results produced during the pilot dredging program may be helpful in evaluating the air impacts. Since that information has not been provided, it is not possible to evaluate the data or to attempt to determine whether it is sufficient for use in extrapolating the results to a "hot spot" remedial action program. In fact it appears that EPA has not utilized the air quality data in their evaluation of the dredging alternative. Since the air quality data have not been included in the Administrative Record, it has not been utilized as part of the HSFS analysis (C. Bering personal communication with R. Hughto September 14, 1989). EPA's analysis and reduction of the data will not be completed until the end of October 1989 at the earliest (A. Fowler personal communication with R. Hughto October 2, 1989). EPA cannot have evaluated the potential air quality impacts of their proposed alternative or of other alternatives that were being evaluated without use of the air quality data. If dredging in the "hot spot" were to result in an oil phase floating on the water column, there would be an enhanced potential for volatilization from this layer. If the dredging were to take place during seasons when it was warmer than the pilot program (which was conducted during the winter), then the volatilization would be enhanced as the volatilization rate increases with temperature. The air pathway of exposure to PCB that would result from the proposed dredging program is a potential significant environmental impact route and should be evaluated in detail. The government has arbitrarily ignored this pathway completely in its documentation of the proposed "hot spot" remedial action.

Likewise, with the toxicity testing results, it is impossible to evaluate the potential impacts of the recommended alternative without the detailed results. On page 44, potential impacts on two species, M. bahia and M. edulis, are mentioned during the pilot study. There is no mention of the potential impacts to these organisms due to the proposed dredging in the "hot spot" or any attempt at a scale-up analysis of the results. The data collected were ignored in the analysis of the dredging program. The results of toxicity testing performed by the government indicated that some impacts on the organisms occurred. In the government's analysis of their data, there is no indication that they attempted to find the cause of the impacts or relate them to the dredging operations. This is of critical importance in that, as mentioned above, the concentrations of PCBs in the "hot spot" are much higher than in the pilot area. If the causes of the impacts were related to these substances those impacts could be greater during any "hot spot" dredging.

One purpose for conducting a toxicity test is to obtain information needed to design a remedial action that would mitigate the causes of any impacts that were observed, should remedial action be implemented at the site. The government has failed to explain the impacts that were observed or to determine whether any mitigating measures will be required as part of the remedial actions that they are evaluating for the site. It is possible that a "hot spot" dredging program could have significant impacts to indigenous organisms, based on the available EPA sampling results. The evaluation of the data collected during the pilot program does not appear to include any detailed analysis or extrapolation to potential impacts of "hot spot" dredging.

Our difficulty in evaluating the data was anticipated. On numerous occasions we requested access to the site to collect independent samples, collect split samples, and to observe the government's operations and data collection procedures during the pilot dredging program. We offered to do so on the government's terms and to assume all responsibility for our health and safety and other potential liabilities that may occur due to our presence on the site. The government rejected our request, which has resulted in our not understanding the data collected or the operations undertaken, and the government has not adequately documented their activities or presented the data that was collected during the course of the program.

On page 29 there is reference to the data indicating that contaminant movement is less than estimates based on the sediment transport model. Again, we need to review data utilized to conclude this as well as documentation and information on the application of the model to determine the validity of each, as well as the comparison.

Page 40 describes a monitoring program that will be undertaken to verify the integrity of the CAD that was constructed. Based on the information in the report, there was not sufficient monitoring of the contaminated material placed in the CAD, of the materials used to cover the contaminated material, or documentation of the CAD surface to appropriately characterize it to allow an accurate follow-up monitoring program. It appears that the material was pumped from one location to another with very little, if any, monitoring.

5.3.2 MONITORING RESULTS

On behalf of the defendants, Rizzo Associates conducted water quality sampling in the vicinity of the area used for the Army Corps of Engineers' (ACOE) pilot dredging program, both prior to and during dredging operations. The purpose of the sampling program was to collect chemical, physical and biological data that could be compared to and supplement monitoring data collected by EPA during the pilot dredging program. The following discussion outlines the relevant sampling efforts conducted by Rizzo Associates, the data obtained during the program, analysis of the results, and comparison to EPA's sampling results. EPA data referenced in this discussion was obtained from the Pilot Study Report. The data evaluation and comparison is made with particular respect to the feasibility of conducting dredging in the "hot spot" area. Monitoring events discussed include aerial photography, turbidity monitoring and sediment resuspension, and dredgehead sampling.

5.3.2.1 Aerial Photography

An aerial photograph taken on November 25, 1988 during the operation of the Cutterhead dredge, which is proposed to be utilized to dredge the "hot spot", visually illustrates the sediment plume created by this dredge. This photograph is included in the appendix. The photograph was taken between 12:00 and 12:30 p.m. and the Cutterhead dredge was in operation between approximately 7:30 and 11:30 a.m., based on data in the Pilot Study Report. Therefore, more significant sedimentation could have occurred after the day's dredging was completed and prior to the picture being taken. The sediment plume surrounds the working dredge and is obviously being transported out of the cove where the experiment was being conducted. Evidence of the sediment plume migrating into the Acushnet Estuary is seen on the photograph. Such a sediment plume was routinely observed during operation of all three dredges.

Although daily dredge production rates are not specified in the Pilot Study Report, data presented in Appendix 1 of the report indicates that the production rate on November 25, 1988 was approximately 35 cubic yards per hour (yd3/hr). This production rate has been recommended by the ACOE as the design rate for full-scale dredging operations. The aerial photograph demonstrates that significant sediment resuspension occurs at this production rate and remains suspended after dredging operations. This production rate has produced a sediment plume large enough to migrate from the immediate work area into the Acushnet River. This cove is an area of low advective and tidal velocities, when compared with the "hot spot" area; dredging in the "hot spot" would result in a resuspended sediment plume that will be transported more rapidly and over a larger area. Because "hot spot" sediments contain PCB concentrations of 4,000 mg/kg or higher, which is orders of magnitude higher than values observed in the pilot test area, a resuspended sediment plume caused by dredging of the "hot spot", will transport PCBs at much higher concentrations than in the pilot test.

5.3.2.2 Turbidity Monitoring

Sediment resuspension in the immediate vicinity of the working dredges was also evaluated using turbidity data collected by Rizzo Associates personnel on two separate occasions. Near top and near bottom water column samples were collected from a small boat using a Kemmerer sampler and were analyzed in the field with an HF Scientific DRT 15C Nephelometer.

Baseline turbidity data was collected at four sample stations in New Bedford Harbor prior to the start of ACOE pilot dredging operations. The sample stations are identified on Figures D-1+D-2. and correspond to those locations used by EPA for water quality monitoring during the pilot program. Sample station No. 2 (referred to as NBH-7 by EPA) is located approximately 800 feet from the dredge areas, and eight water column samples were collected on November 11, 1988 to establish baseline turbidity conditions. The samples had turbidity values ranging between 3.3 and 10.2 nephelometric turbidity units (NTU), with a mean of 5.7 NTU. Turbidity measurements at the other three sample stations ranged between 1.4 and 9.3 NTU.

Turbidity monitoring conducted within approximately 100 to 700 feet of the active dredges was performed on December 22, 1988 and January 13, 1989 from a small boat. The Matchbox and Cutterhead dredges were operating during these two data collection events. Turbidity measurements in December 1988 ranged between 5.2 and 130 NTU, and had a mean response of 34 NTU. The January sampling data yielded turbidity measurements between 8.0 and 121 NTU with a mean value of 36 NTU.

The high turbidity values of 121 and 130 NTU represent an approximate 20-fold increase in mean turbidity during dredging over the observed background level. Significantly elevated turbidity measurements (48 NTU) were recorded at a distance of approximately 400 feet east of the Cutterhead dredge. These results have obvious negative implications for any on-site dredging operations.

The Cutterhead dredge has been recommended for "hot spot" dredging by the ACOE. The baseline and dredging turbidity data indicate that increased turbidity, both adjacent to and in the general vicinity of the dredge, resulted from the Cutterhead dredging operations. Elevated turbidity values were measured in the water column up to 400 feet from the working dredge and indicate that resuspended sediment was being transported and distributed to the estuary. "Hot spot" sediment contains PCB concentrations over 4,000 mg/kg and its resuspension would release PCBs into the Acushnet estuary, which would, in turn, be spread over a wide area due to advective and tidal velocities in the estuary.

5.3.2.3 Sediment Resuspension

Sediment resuspension at the dredgehead was measured by EPA as a function of total suspended solids, dredge swing speed and the water depth. Little information was presented in the

Pilot Study Report pertaining to the specifics of how the sampling device was attached to the dredgehead, its location relative to the dredgehead intake, the method by which the sampling device collected water column samples, or how the samples were physically retrieved from the sampling device. This information is critical in order to evaluate whether or not representative water column samples were collected. The ACOE should present a detailed discussion of the sampling device set-up, collection technique, and rationale for the equation used to calculate sediment resuspension rates for public review. Otherwise, there is no basis for this conclusion.

Resuspension rates for the Cutterhead dredge were calculated for five days of operation and the mean resuspension rates for each day ranged between 8.5 and 60.5 grams per second (g/s). These values are equivalent to 67 and 479 pounds of sediment released per hour (lb/hr), respectively. A mean resuspension rate of 78 lb/hr (9.8 g/s) was measured on the day that the aerial photograph was taken. Resuspension rates near 479 lb/hr would be expected to create a sediment plume of larger magnitude than that shown in the aerial photograph. Although the EPA resuspension rates cannot be compared to established water quality standards, the Cutterhead dredge has the potential to resuspend hundreds of pounds of sediment per hour (Gahagan & Bryant, 1989).

Sampling data presented in the June 1989 ACOE pilot dredging report indicate that the Cutterhead dredge resuspended contaminated sediment at an average rate of 21.6 g/s (171 lb/hr), at a mean production rate of 20 yd3/hr (p.30). This mean resuspension rate was calculated from the raw data in Table 1 of Appendix I and it differs from the mean resuspension rate of 17.3 g/s (p.29) calculated by the ACOE from the same data. The ACOE and E.C. Jordan both suggest that a production rate of 35 yd3/hr could be achieved during full-scale implementation. This value represents a production rate increase of 75 percent over that attained during the pilot-scale study, and although a specific correlation between production rate and sediment resuspension rate is not presented by the ACOE, an increased production rate would be expected to increase the sediment resuspension rate. E.C. Jordan's Feasibility Study predicts a sediment resuspension rate of 20 g/s during full-scale implementation of dredging. This rate is similar to, but lower than, the mean resuspension rate observed during the pilot-scale study (21.6 g/s) at a 20 yd3/hr production rate. Considering this optimistic assumption that resuspension will not increase from the mean with a 75 percent increase in production and the more complex hydrodynamic conditions in the "hot spot," it appears that the predicted sediment resuspension rate of 20 g/s has been significantly underestimated by the government. The validity of predicting a production rate increase of 75% while making no attempt to correlate this value to a revised sediment resuspension rate is questionable. If the ACOE has data to support the predicted resuspension rate relative to the predicted production rate then this data should be presented. If the lower production rate would have to be utilized to achieve the target resuspension rate, the total resuspended mass of PCBs would be much higher than predicted, as the dredging period would be much longer.

For comparison purposes, if the relationship between production rate and the sediment resuspension rate was linear, the predicted production rate of 35 yd3/hr correlates to a sediment resuspension rate of 37.8 g/s (299 lb/hr). Therefore, based on data available to date, the mean sediment resuspension rates during full-scale implementation are expected to be between 171 and 299 lb/hr. These values represent contaminated sediment release rates between 1.3 and 2.3 tons per work week (5 days per week, 3.12 hours per day which corresponds to the pilot-scale mean daily work time). Using the mean PCB concentration of 8,800 mg/kg for "hot spot" sediments, as designated by E.C. Jordan's Feasibility Study, the above-referenced sediment release rates correspond to the release of 23 to 40 pounds of PCBs during each week of "hot spot" dredging. The sediments would be transported and distributed throughout the Acushnet Estuary due to river currents and tidal influences, and could cause adverse impacts to the environment.

Measured resuspension rate data for the Cutterhead dredge presented in the Pilot Dredging Report indicate no strong correlation between ladder swing speed and resuspension rate. A stronger correlation between the date of dredging and resuspension rate existed (Gahagan & Bryant 1989). The data presented are either of insufficient quality to define the variables that are functionally related to the resuspension rate or the test was to short to quantify the relationship between resuspension and other operating parameters. Regardless of the cause, the data are not sufficient to extrapolate resuspension rates in the "hot spot" area based on the results of the pilot test in the cove.

The ACOE and E.C. Jordan have assumed that the pilot study sediment resuspension rate of 171 lb/hr will not change with a production rate increase of 75 percent during full-scale implementation. No model or data has been presented by the ACOE or E.C. Jordan which supports this assumption, and no discussion is presented to explain the rationale behind the assumption. A detailed analysis of the relationship between dredge production rate and sediment resuspension rate should be prepared by the ACOE to evaluate the potential sediment resuspension rate during full-scale implementation.

The ACOE has recommended the Cutterhead dredge for use in New Bedford Harbor, should dredging be involved with remedial actions. The aerial photograph, turbidity measurements and sediment resuspension data confirm that a sediment plume was created by the Cutterhead dredge during the pilot-scale dredging program. Documentation of the plume migrating from the dredge area, which has low advective velocities, is provided by the aerial photograph and the turbidity monitoring program. Turbidity measurements greater than 20 times background turbidity values were observed near the dredge and a turbidity of 48 NTU, over eight times the observed mean background, was measured approximately 400 feet east of the Cutterhead dredge during its operation. The sediment resuspension rate of 20 g/s predicted for "hot spot" dredging underestimates the potential for sediment resuspension. Based on the predicted "hot spot" production rate of 35 yd3/hr, sediment resuspension rates could be expected to be between 21.6 and 37.8 g/s. These resuspension values correspond to 23 to 40 pounds of PCBs that will be released during each day of "hot spot" dredging. The government has predicted the amount of resuspension but has not provided an analysis of the potential environmental impacts of such resuspension. The evaluation of effectiveness of "hot spot" dredging must include an evaluation of short-term and long-term impacts that will result from implementation, particularly since EPA's own predictions are that the flux due to resuspension during dredging will be greater than the current PCB flux (HSFS Table 5-2). All of these estimates of PCB and sediment resuspension in the "hot spot" are based on the assumption that the PCB resuspension mechanisms in the "hot spot" are the same as in the pilot area. EPA's estimate of the flux during dredging has likely been underestimated because it does not consider the oily phase that has been observed in the area where dredging is proposed.

5.3.2.4 Production Rate

The design production rate of 35 yd3/hr for full-scale dredging operations is based on the Cutterhead dredge making "one pass" over an area with an average depth of cut of 1.5 feet. Due to the concentrations of PCBs in the "hot spot" and the results of the pilot study, it is anticipated that a minimum of two passes over each shallow area of contamination (12 inches in depth) would be required to ensure that the target "hot spot" sediments are removed.

The ACOE Report states that a significant reduction in PCB levels remaining in the sediments was achieved by performing a second pass over the dredge area (page 23). Specifically, the mean PCB concentration remaining in the Dredge Area 2 sediments after two passes with the Cutterhead dredge was 10 mg/kg. Conversely, dredge area 1 sediments exhibited a mean PCB concentration of 84 mg/kg after only one pass with the Cutterhead dredge. Dredge area 1 sediments had mean PCB concentrations of 280 mg/kg (0 to 6 inches) and 50.5 mg/kg (6 to 12 inches) based on composite sediment cores collected by Rizzo Associates. Based on this sampling data and the remaining PCB concentration of 84 mg/kg after a depth of cut of 1.5 feet, it is evident that the "one pass" scenario failed to remove the sediments from the 6 to 12- inch horizon. The "two pass" scenario, with an average depth of cut of 1.1 feet, removed the 6 to 12-inch sediment horizon from Dredge Area 2, which had a mean PCB concentration of 37.6 mg/kg, based on Rizzo Associates' sampling data. Therefore, the pilot dredge program demonstrated that a "two pass" scenario would need to be implemented during "hot spot" dredging for PCB contamination in the top 12 inches of sediment. Additional passes of the dredge will likely be necessary when dredging deeper sediments as well.

A production rate of 16 yd3/hr resulted during the operations when a second pass was incorporated into the work schedule (20 yd3/hr was the mean combined production rate achieved for the Cutterhead dredge during "one pass" and "second pass" dredging events). If the government believes that a production rate of 35 yd3/hr is attainable in the "hot spot" sediments, then an analysis and explanation supporting the increased production rate over the pilot-scale rate is required in order to demonstrate its viability. It is likely that a minimum of a second pass will be required anywhere in the hot spot sediments to ensure one foot PCB sediment is removed, and the government must address this issue. The government's lack of a detailed and comprehensive evaluation of their proposed alternatives is demonstrated again in the production rate discussion. It appears that at least 10 percent additional dredging will be required to remove the target depth. This adds additional resuspension, cost, uncertainty, and time to the overall program.

5.3.2.5 Dredgehead Sampling

EPA conducted water sampling at the dredgehead apparatus on each of the three dredges to evaluate total PCB concentrations in the immediate vicinity of the working dredges. Specific criteria concerning the mounting of the sampling devices, their location on each dredgehead, and the sampling procedures used by the ACOE were not presented in the June 1989 report. Therefore, the representativeness of the results and the actual meaning of the data could not be evaluated.

Background total PCB concentrations in the water column were measured at 2.2 ug/l (mean) by Rizzo Associates at Sampling Station No. 2 (mouth of pilot dredging cove) prior to dredging. During dredging of contaminated sediment, mean total PCB concentrations in the water column were measured to be 13.1, 103 and 50.3 ug/l for the Cutterhead, Horizontal Auger and Matchbox dredges, respectively. These concentrations are elevated over background PCB concentrations in the water column by a factor of up to 50 and indicate that significant levels of PCBs were released when dredging in an area of relatively low PCB concentrations (compared to "hot spot" concentrations).

The mean PCB particulate concentration measured by EPA at the dredgehead of the Cutterhead dredge was 22.3 ug/l. With sediment PCB concentrations 200 times higher in the "hot spot" sediments, the potential for water column concentrations orders of magnitude higher than those observed during the pilot program are expected during any "hot spot" dredging. This is without consideration of the NAPL oils that have frequently been observed in the sediment in the "hot spot" area. Such oils are certain to resuspend during any dredging operation, likely increasing resuspended PCB concentrations by an order of magnitude or more, and EPA proposes no controls during "hot spot" dredging. The resuspended oils could remain suspended and migrate throughout the estuary system.

No evaluation of this migration or the environmental impacts has been presented by the government. The resulting sediment plume has the potential to contain and transport significant quantities of PCBs and oils. The pilot dredging study did not accurately address this potential because it was conducted within a cove that was isolated from the Acushnet River currents and contained relatively low PCB and oil concentrations in the sediments.

Dredgehead samples for PCB analyses were only collected on 16 of the 35 days on which the dredges operated in contaminated sediment. This limited sampling program should have evaluated the water quality during all of the problem situations actually encountered, such as clogging of the dredgehead and sediment resuspension from the work boats. Consequently, the data may not fully represent of the potential for PCBs to be released. Dredgehead clogging, either due to mechanical problems or debris in the hot spot sediment, could release additional sediment and PCBs into the water column. The June 1989 ACOE report did not address the levels of PCBs released during pilot study problem situations, and this potential needs to be evaluated for "hot spot" dredging. If the daily logs had been included with the ACOE report, such problem situations could have been evaluated.

5.3.2.6 Summary and Conclusion

Chemical, physical and biological monitoring during the dredging pilot study demonstrated measurable and possibly very significant environmental impacts to the study area during pilot dredging. The potential impacts to the river and the estuary are expected to be greater during the proposed program due to the elevated PCB concentrations in the sediments and significantly higher advective currents and different physical characteristics that exist in the proposed dredging area. The chemical, physical and biological databases collected during the pilot dredging study do not support the development of dredging activities in the "hot spot" area. On the contrary, the turbidity and chemical water quality data, as well as physical observations documented in the aerial photograph, demonstrate that the dredging causes sediment resuspension. Data presented in the government reports indicate that significantly increased PCB transport will occur during dredging.

However, no analysis of the impacts of the implementation of "hot spot" dredging is presented. No consideration or analysis is provided to determine the potential impacts of dredging in the "hot spot", based on these results. Based on the higher advective and tidal currents, the higher sediment concentrations and the presence of oils in the "hot spot" sediments, it is apparent that an impact much greater than that observed during the pilot study will occur. The government has made no effort to quantify that impact or to present a full evaluation of the potential water quality impacts of the "hot spot" dredging. The usual purpose for performing a pilot study is to collect the data needed to evaluate the implementation of the technology in full scale. While resuspension, production, and environmental data were collected during the Corps' pilot program and presented in the HSFS, no attempt to estimate the environmental impacts of the "hot spot" dredging was presented in the report. Without such an evaluation, the public cannot prepare responsible and comprehensive comments on EPA's proposal. A quantitative analysis of the potential environmental impacts should be prepared and provided to the public for evaluation prior to making a commitment to implementing a dredging program.

The conclusions of the PDP report summarize resuspension data. Again, the raw data and the detailed information on the collection method, location, frequency, etc. is critical to evaluate any conclusions. Resuspension is not called a problem. Aerial photographs taken during the pilot dredging program, however, indicate that there was significant resuspension and a plume of sediment existed not only at the dredgehead but for some distance away from the dredge. Therefore, the complete data set must be evaluated in detail.

While the pilot dredging report may provide a detailed description of goals and objectives, it does not contain detailed descriptions of the methods used and results obtained. In the attempt to satisfy those goals and objectives, the data contained in the report is the sum total of the data produced. We believe that insufficient information is available to provide conclusive findings on performance, cost, and operational control for the proposed "hot spot" or a full-scale program.

5.3.3 Decision Criteria

The decision criteria for the pilot dredging study called for a formal committee, known as the Decision Criteria Committee. The "purpose for the criteria committee was to set forth chemical and biological criteria which, if exceeded, would require a decision regarding suspension, continuation, and/or modification of operations"; decisions were to be made by the Committee. Specific criteria were established for a variety of constituents; data were to be collected during the pilot study from which decisions would be made by the Committee.

The Pilot Dredging Report indicates that the government ignored its own procedures. At the bottom of page 44, there is discussion of the lack of need for the decision criteria committee to meet to discuss results, despite the fact that some criteria were reportedly violated on several occasions. It is not apparent who made the decisions for the committee not to meet and who was responsible for deciding that the environmental impacts of the criteria exceedences were not significant or not related to the pilot study. It is possible that important data that could have been collected or impacts of the dredging program were missed, despite detailed criteria in the work plan to do such investigation and evaluation. The notes of the meetings that did occur and decisions made by committee members should appear as an Appendix to the report.

On behalf of the defendants, Rizzo Associates formally requested access to the Site during the pilot dredging program to collect samples and to observe actual dredging operations and the decision criteria process. We were denied access, despite expressing willingness to assume responsibility for our personnel and their actions. As a result, much of the environmental quality and operational data we need to evaluate the pilot dredging program has not been made available to us.

The operations of the Committee and the review of data did not follow the plan or the procedures that the public were told would be followed; therefore, the evaluation of the data during operation was lost and evaluation of potential impacts not performed. The protection of the environment to be provided by that procedure was not provided.

5.4 CDF CONSTRUCTION AND STABILITY

On page 35 of the Pilot Study Report, there is discussion of construction of additional CDFs and the fact that the fill placement methods used in construction of the existing CDF would be appropriate. There is no mention of the significant mud wave problems that developed during the construction of the existing CDF that resulted in significant construction delays, as well as decreased storage capacity in the cell. The mud wave impact and its resolution should be incorporated into any design/construction discussion for CDFs in water.

On page 37, the existing CDF dike is called stable. What is the basis for this conclusion and is long-term monitoring being conducted to ensure that mud wave problems have been mitigated and that the dike is truly stable? No data related to the settlement of the dike or any ongoing monitoring have been presented. No ongoing maintenance of the dike is being conducted. Large and deep erosion channels have been observed around the full circumference of the dike. Significant re-construction must be completed before it is used as part of a remedial action, and there is real question about the CDF's integrity based on defendants' observations. A maintenance program must be developed for the remedial action period. We recently attempted to obtain access to the site during the comment period to view the current situation, but EPA would not identify the individual to coordinate the visit.

There must be a real and sound basis for any conclusion that the dike is stable. No mention is made of the potential for contaminant leaching from the CDF into the groundwater and the river, which is an important consideration for any CDF that will contain contaminated sediments.

In the Corps' report, it refers to construction of a CAD as similar to level bottom capping or in situ containment. The pilot study demonstrated the viability of CAD disposal, which demonstrates the viability of capping, as well. In the HSFS, in-place containment is written off from consideration due to feasibility reasons. This is an inconsistency in the writeups and it appears that the pilot testing did demonstrate the viability of capping of contaminated sediments.

5.5 OPERATIONAL DATA SUMMARY

Gahagan & Bryant Associates (1989) has reviewed the Pilot Study Report. Their review was limited to those aspects of the Report related to dredging and the placement of dredged material in the CDF and the CAD. Their comments are generally focused upon the dredge equipment, the "near-field effects" of the equipment such as "sediment resuspension" and the disposal operations, particularly with the cutterhead dredge.

The Pilot Study Report reaches four principal conclusions regarding effectiveness and operation of the dredging equipment in the areas of:

- Recovery of PCB-contaminated materials
- Quantity of material removed
- Effects of dredge operational procedures
- Costs of dredging

The Report does not contain adequate information or data to substantiate the claims made for the above aspects of the proposed work. General comments on the four principal conclusions of the report are provided below.

5.5.1 RECOVERY OF CONTAMINATED MATERIALS

The Report (page 23) states that in Area 1 the cutterhead dredge left the bottom with an average of 84 ppm PCB after one pass with an average cut of 1.5 feet. In Area 2 the same dredge left the bottom with an average 10 ppm PCB after an average cut of 1.1 feet using a second or sweep pass. No data is presented which substantiates this statement. Indeed, no mass balances for materials and PCB transport from the dredged material or the disposal areas are presented to demonstrate that material and PCB were actually removed from the dredging areas.

It is an obvious possibility that the PCB levels in the two different areas before dredging could contribute to a difference in after dredging conditions. Also, the actual dredging procedures could, without careful control and measurement of effects, cause relocation, burial or otherwise lose track of contaminated materials.

Three aspects of the dredging process are of principal concern:

- Dredge position
- Cutterhead location
- Before and after dredging surveys

Dredge Position: The position of the dredge must be carefully and continuously measured in order to assure that the dredge is over the desired dredging area. The Report contains no indication that a high precision survey system was used in the study.

Cutterhead Location: The depth of the Cutterhead with respect to the face (depth of material) being dredged is a critical factor in production and in the disturbance of the bottom. Also, the depth of the cutterhead must be frequently adjusted to maintain a relatively constant digging face while accommodating tide changes (up to 1.4 ft/hr change was reported) as well as variations in bottom elevation. The Report contains no data on cutterhead depth.

Before and After Dredging Surveys: Depth surveys as well as cores of the bottom to an adequate depth are required to determine the volumes of material removed as well as the recovery of PCB-contaminated materials. The hydrographic surveys must be available on a near real-time basis in order to control the dredging operations. Although dated June 1989, five months after the placement of the CAD cap, the Report does not contain cross sections showing the cap condition.

The Report (pages 45 and 47) refers to preliminary sediment sampling and sampling for removal efficiency, but the results are not included in the report. It states that these data will then be used in determining the removal efficiency of each dredge. If this data is not in the Report and it will be used to determine removal efficiency, how can the report state that the dredges are efficient in removal?

5.5.2 QUANTITY OF MATERIAL REMOVED

Survey procedures used in the Pilot Study are not described, nor are cross section data presented to confirm the estimated quantities. The few cross sections which are presented are not conclusive. It is significant to note that the Interim Report is dated June 1989, five months after the CAD was filled. After this time the Report still does not contain cross sections of the work accomplished. This is an indication of the lack of real time control of the work. It also casts doubt upon the claims made for precise control of dredging depths and quantities of materials removed when no data substantiating that control is published in the Report.

Adequate cross sections and mass balances for solids and PCB are a critical measurement and control requirement for this project.

5.5.3 EFFECTS OF DREDGE OPERATIONAL PROCEDURES

The Report discusses testing for the effects of dredge operational procedures, ladder swing speed, cutterhead rpm, rate of advance and depth of cut. Qualitative terms are used (page 30) such as "reducing as much as possible", "reducing the rpm of the cutter" and "minimizing the depth of cut." Actual data given do not indicate any good correlation between ladder swing rate and "sediment resuspension." No data are presented on cutter rpm or depth of the cutter while dredging.

5.5.4 COSTS OF DREDGING

The only cost data presented in the Report is the daily rental rate for the dredge, operator and attendant plant. No estimate is provided for scaling up the pilot study rental rate to a cost for the "hot spot" or full-scale dredging programs.

An appropriate cost estimate would be based upon an analysis of the job conditions, special equipment costs, project management requirements, equipment productivity, special environmental requirements, special worker health and safety requirements and the requirements of the CDF and effluent treatment operations and their effects upon dredging productivity.

In general, adequate data are not presented in the Report to support the claims made relative to the effectiveness of dredging as a means of recovering PCB-contaminated materials from the Upper Estuary.

After review of the report, Gahagan & Bryant concluded that adequate data were not presented to support the claims made relative to the effectiveness of dredging and a means for recovering PCB contaminated materials from the upper estuary (Gahagan & Bryant, 1989). A copy of these comments is attached.

5.5.5 DREDGE EQUIPMENT

On page 31 of the pilot dredging report, it states that common dredging equipment will be available to do the work. The proposed project is complex and the availability of common equipment should be irrelevant. It is actually a misleading and improper criterion for the evaluation of equipment. While EPA favors proven and demonstrated technologies and equipment for implementation at Superfund sites, the nature of the proposed project is such that it warrants the consideration of specially designed equipment in order to be able to meet the objectives under the physical conditions that exist at the site. The reliance of the analysis on selecting demonstrated equipment is an emphasis on the wrong criteria in the evaluation of remedial action alternatives. This could open implementation of the project to contractors with no experience in contamination work. Demonstration should be of equipment that will best meet the objectives of the program, not on encouraging inexperienced contractors with flexible and general use equipment to bid on a project for which they have no experience. This could result in a failure of the program and the spreading of contaminated sediments around the Harbor.

5.5.6 DURATION OF PILOT TEST

The pilot study that is described in the report took place over a ten month period, with 53 hours of dredging of contaminated material during that period. Three different dredges were utilized and limited data were generated relative to the performance of the dredges and the environmental impacts of the deployment; particularly as it can be extrapolated to the "hot spot" dredging. We believe that the limitation of data is a direct result of the limited hours of pilot dredging and the lack of data relative to resuspension in the "hot spot" area was directly related to both the limitation of number of hours of the pilot dredging and the location in an area totally unrelated to the "hot spot." The government has attempted to extrapolate data originally not intended to be extrapolated into the "hot spot" area. The limited data available based on the design of the pilot study has resulted in an inadequate extrapolation process and the data necessary for such extrapolation was not available. The extrapolation and the application of pilot dredging results to the "hot spot" is not based on good scientific principles.

5.6 CONCLUSIONS

In EPA's "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, EPA/540/G-89/004 October, 1988," it states that "treatability studies are conducted primarily to ... provide sufficient data to allow treatment alternatives to be fully developed and evaluated ... and reduce cost and performance on the certainties of treatment alternatives to acceptable levels so a remedy can be selected." It is obvious that the treatability studies that have been conducted do not conform with the requirements of EPA's own guidance documents. EPA has failed to conduct any treatability studies of its recommended remedial action alternative; despite the serious uncertainties concerning what the incinerator residue treatment technology will be, the pilot dredging study cannot be considered a proper treatability study because of the extreme dissimilarities between the study area and the "hot spot." The selection of dredging as the remedial action alternative is not appropriate until the technology has been demonstrated to be effective and feasible for the area to be dredged and until EPA demonstrates that it has considered the potential adverse environmental impacts of implementing dredging in that area. The pilot work done in the cove did not accomplish either goal and, hence, did not demonstrate the feasibility of the proposed remedy. The government utilized a study that was developed to evaluate dredging equipment and operation and expanded it to an evaluation of alternatives for "hot spot" dredging. This was done without a sufficient database to extrapolate from the pilot area to the "hot spot." The results of the sampling work raise many questions relative to the feasibility, environmental impacts, and cost-effectiveness of "hot spot" dredging that have not been addressed by the government.

Much of the data collected during the program to support the analysis and selection of dredging has not been made available. This includes air quality and toxicity data, as well as background sediment and water data, dredge program operational data and the model work. The government has based the conclusions of the Pilot Dredging Report and recommendations for a remedial alternative with an estimated cost exceeding $14 million on unavailable data. The public has not had the opportunity to review those important data or to evaluate the potential environmental impacts due to its not being available.

Aerial photographs and water column data collected by the government and Rizzo Associates have indicated that significant resuspension above baseline conditions occurred during the pilot program. Dredging in the "hot spot" would result in much more significant resuspension and the resulting short-term environmental impacts. The "hot spot" is characterized by NAPL phase oils and much higher concentrations of contaminants in the sediment that would be resuspended during a dredging program. The resuspension of the more highly concentrated sediments and the NAPL phase could have possible adverse impacts on the estuary which have not been addressed or quantified in the government reports. The advantage or the effectiveness of implementing a remedial action with this resulting environmental impact has not been presented, leaving the justification for implementing the recommended remedy questionable.

The arguments made in the EPA studies for eliminating many remedial action alternatives from further consideration are based on the lack of demonstration in the field or lack of pilot testing data. The same argument could be made to eliminate "hot spot" dredging and the related sediment handling and treatment. However, the HSFS focused solely on dredging, since the government expended millions of dollars on a pilot test of dredging, while giving scant consideration to other remedial action alternatives. If the same effort and funding had been applied to demonstrations of other alternatives, the results of the alternative evaluation may have been very different. Design and implementation should not have been undertaken for such an unproven technology until the proper feasibility and engineering support data have been collected and similar work was completed on other alternatives to justifiably eliminate such alternatives.

A pilot program was conducted in an area that was inappropriate for such a study, if its objective was to demonstrate the applicability of the dredging and treatment alternative for the "hot spot" area or other more contaminated areas of the site. The data analyses that were conducted did not indicate that an extrapolation to more contaminated areas was conducted, or that a similar program in a more contaminated area would successfully demonstrate that adverse environmental impacts would not occur. The evaluation of dredging is not appropriate without such an analysis. EPA relied on a limited database to conclude that it has demonstrated the engineering feasibility of the recommended alternative. Based on their conclusion, the government maintains that dredging in general does not resuspend PCBs. This conclusion is totally inappropriate and does not represent good scientific judgement. The cove area utilized has different sediment and hydrodynamic characteristics from the "hot spot" area. EPA has extrapolated data inappropriately and decided to implement a very expensive remedial action alternative without the basic data to document the potential environ mental impacts of such an implementation.

The government's lack of sensitivity to environmental impacts was demonstrated during the pilot program with their construction of the CDF within the estuary. A large volume of estuary was destroyed by the construction of a dike that was used as a CDF without consideration for the normal environmental mitigation that is undertaken as part of such projects.

The government arbitrarily violated its own procedures. They failed to convene their decision criteria committee during the pilot program. Exceedences of established criteria were observed, but the process that the government had promised to the public to implement to review such exceedences was ignored without notification of the public. In their haste to push the pilot program forward, the evaluation of important data and established criteria to protect the environment were ignored. This resulted in lost opportunities to evaluate environmental impact data with the public and other interested and potentially impacted parties.

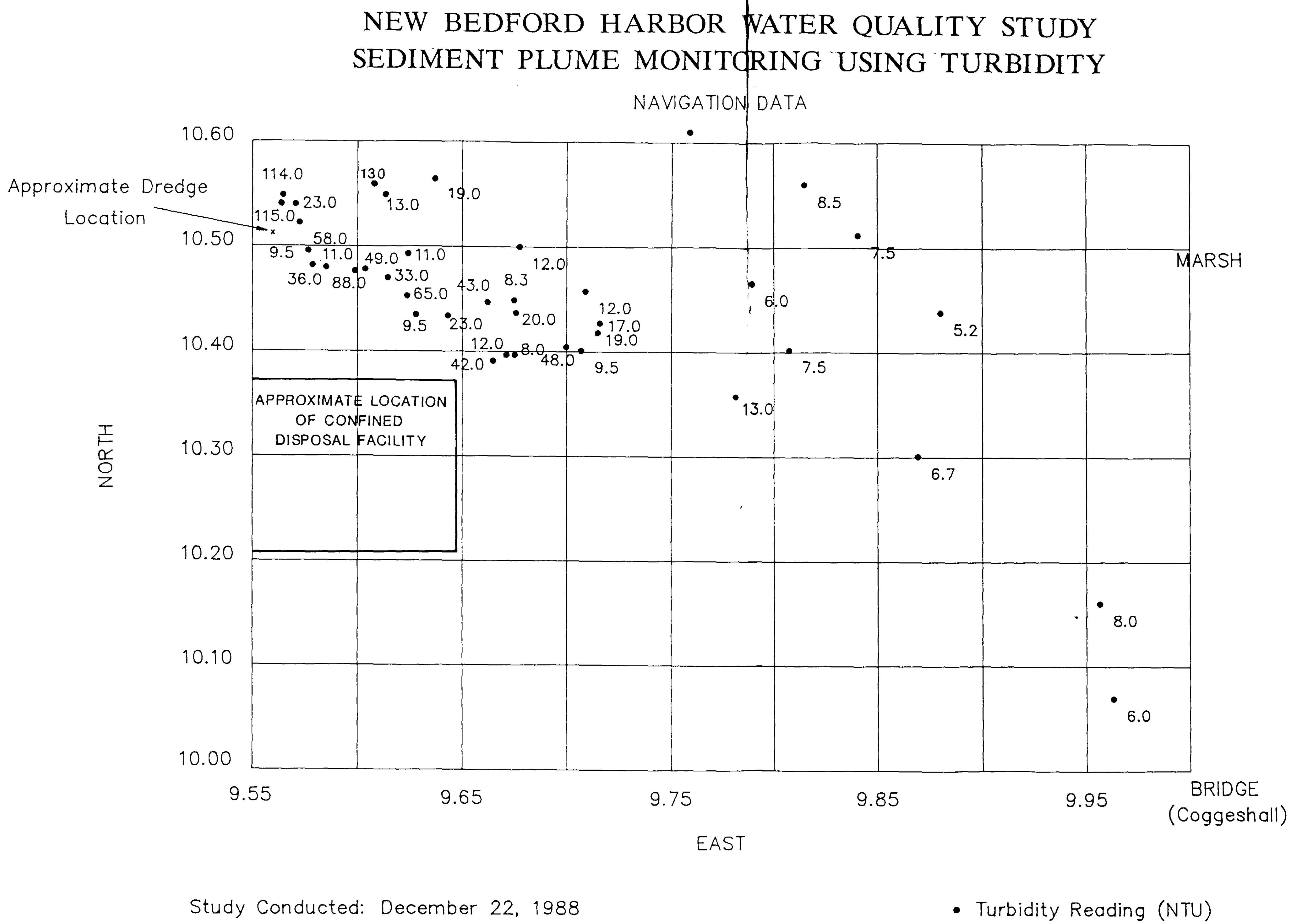
The pilot study that was conducted was more a design study for dredging than an evaluation of the feasibility of dredging. The government spent most of its time justifying dredging rather than identifying the potential impacts and methods for mitigating those impacts during the full-scale or larger application as would be expected in an engineering pilot study. The feasibility of dredging in the "hot spot" was clearly not demonstrated during the study due to the lack of comprehensive data collected, the difference in enviro- nmental conditions between the pilot area and "hot spot" area and the demonstration of resuspension during the pilot study with no mitigation plan identified for the full- scale study.

The turbidity and aerial photography data collected during the pilot study clearly indicate that there was significant resuspension in the pilot cove during the pilot program. Such resuspension impacts would likely be magnified for dredging undertaken in the "hot spot" area.

EPA has planned "hot spot" dredging production rates at 75 percent above the rate documented by the Corps during the pilot study. However, they predict that the sediment resuspension rate at that production rate will be less than the mean value observed by the Corps at the lower rate. It is likely that higher production rates will result in higher resuspension. The government has certainly underestimated the resuspension rate that will occur in practice if the program is implemented as they plan.

EPA has not considered the presence of oils in the "hot spot" area. These oils have been observed by numerous investigators. Relatively low impact work in the area has caused the oils to surface in the upper estuary. It represents a significant potential for environmental impact beyond the resuspension of sediment that dredging will cause if a dredge would operate in the area has caused the oils to surface.

The implementation of dredging in the "hot spot" is inappropriate based on the data presented. It has the potential for significant environmental impacts based on the data, and cost overruns are likely if the plan is implemented as presented.


NEW BEDFORD HARBOR WATER QUALITY STUDY
SEDIMENT PLUME MONITORING USING TURBIDITY
NAVIGATION DATA
NORTH
EAST
10.60
10.50
10.40
10.30
10.20
10.10
10.00
9.55
9.65
9.75
9.85
9.95
Approximate Dredge Location
APPROXIMATE LOCATION OF CONFINED DISPOSAL FACILITY
MARSH
BRIDGE (Coggeshall)
114.0
23.0
115.0
58.0
9.5
11.0
36.0
88.0
130
13.0
19.0
49.0
11.0
33.0
65.0
9.5
23.0
43.0
8.3
12.0
20.0
12.0
17.0
19.0
12.0
8.0
42.0
48.0
9.5
8.5
7.5
6.0
5.2
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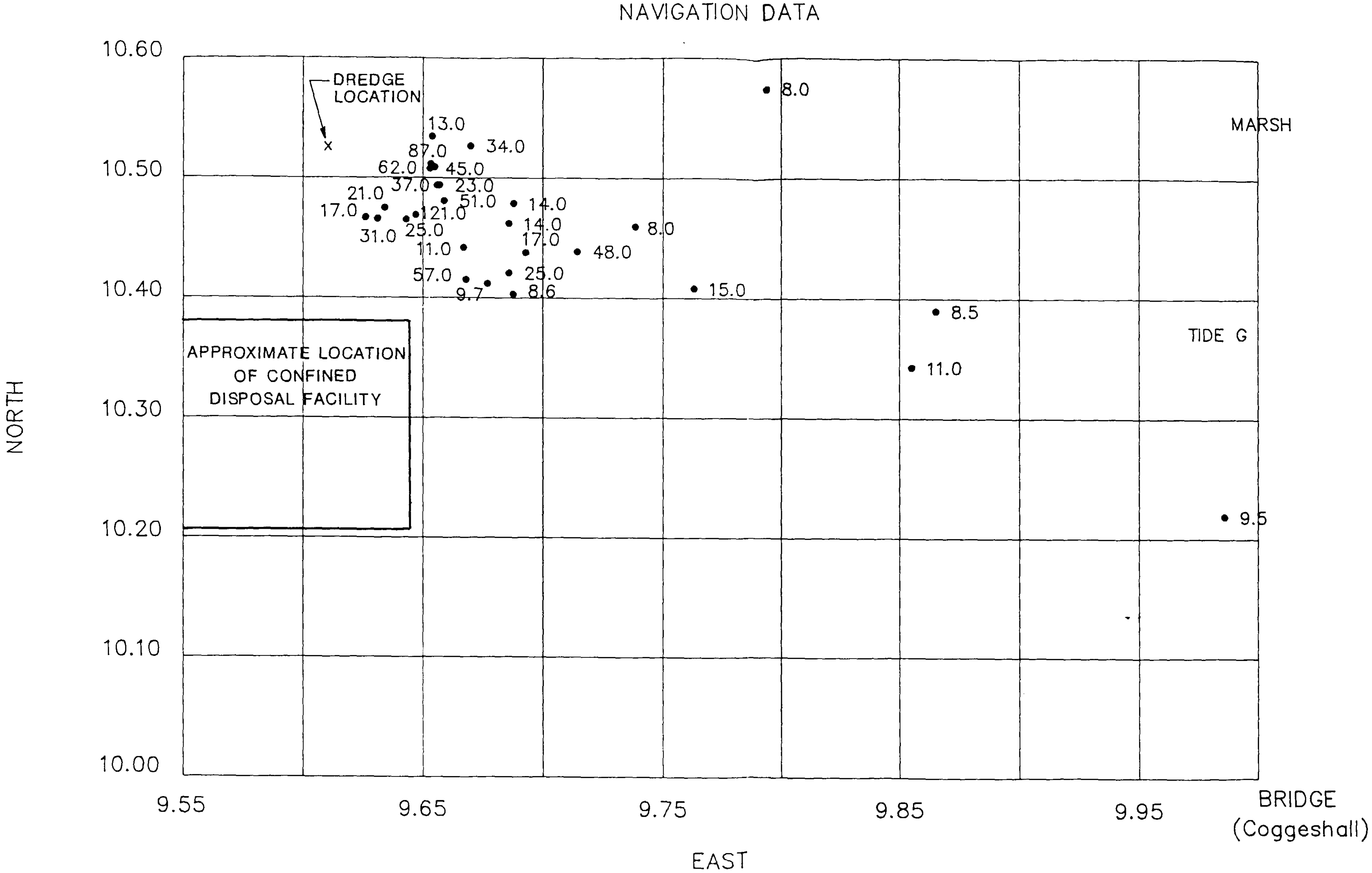
6.0
Study Conducted: December 22, 1988
• Turbidity Reading (NTU)

NEW BEDFORD HARBOR WATER QUALITY STUDY
SEDIMENT PLUME MONITORING USING TURBIDITY



Study Conducted: January 13, 1989

• Turbidity Reading (NTU)

6.0 ASSESSMENT OF INCINERATION ALTERNATIVE

The proposed remediation scheme in the draft Feasibility Study includes the dredging of sediments from the"hot spot"; pumping the dredged sediment slurry to the existing CDF; settling in the CDF; dredging from the CDF; dewatering of the dredged sediments; incineration of the dewatered solids; and treatment of water from the dewatering process, the supernatant from the CDF, and the incinerator process water prior to discharge into the estuary.

There are numerous significant uncertainties in the proposed scheme that need to be addressed as they will have major impact on the feasibility of the alternative. Figure 7-2, Alternative HS-2 Process Flow Diagram and the accompanying text in Sections 5 and 7 of the HSFS raise serious questions about the underlying analysis including practical aspects of how the alternative would operate, the sensitivity of the operations; and cost of the alternative to variations in process conditions that might be expected after implementation. Questions regarding the selected design conditions are also raised.

6.1 MASS INPUT INTO THE TREATMENT SYSTEM

6.1.1 Sediment Flow into CDF

The report states that the USACE recommended operating the cutterhead dredge at a flow rate of 2,100 gallons per minute for an operating time of 3 to 4 hours per day. At 2,100 gpm, 4 hours of pumping per day yields 504,000 gallons per day. However, the process flow diagram indicates that incoming flow rate from the dredging operation is 690,000 gallons per day, a 37 percent increase over the maximum USACE recommended value. This flow rate would cause additional resuspension.

6.1.2. Sediment Solids Are Underestimated

a. EPA assumes that there are 6,000 dry tons of solids in the 10,000 cubic yards of "hot spot" sediment, based on estimated moisture content of about 50 percent by weight in the sediment. The measured range of sediment moisture is 30 to 60 percent, with the majority consisting and will underestimate the possible quantity of solids to be processed. The additional solids will compromise the feasibility of operating the sediment and water treatment systems as planned since the loadings will change significantly.

The report does not address the impact and expense of running the system for a longer period as a result of the dredging operation taking longer because of higher bulk volume of dredged sediments with higher in-situ sediment solids content. Given EPA's analysis, it was improper not to include a sensitivity analysis relative to design, operation and cost of receiving sediments over the full range of the estimated 30 to 60 percent moisture content. With a factor of two difference it is clear that the dewatering system required further analysis. The impacts of EPA's failure to properly analyze these uncertainties are far reaching since all other sediment and water handling and treatment technologies included in the alternative. For example, if the highest solids levels were realized, significantly greater amounts of sediment volume to be incinerated would result. In addition, settling time within the CDF and operational characteristics of the dewatering system would likely change. There would also be significant impacts on the cost estimate, as the greatest costs are related to the volume of sediments being incinerated and the expected solids content varies by more than a factor of two.

6.1.3. Solids from the Pilot Operation

The report states that approximately 6,500 cy of material from the pilot study is already in the CDF. This sediment volume was not included in the total system mass balance and calculation of costs for processing through the treatment system and disposing of residual materials However, when the "hot spot" sediments that are placed in the CDF are dredged out to be dewatered and incinerated, the existing 6,500 cy, as well as the solids that have eroded from the CDF walls and the existing CDF walls that will come into contact or mix with dredged sediments, will be mixed with the "hot spot" sediments.

EPA erred in failing to utilize a factor of safety of at least 20 percent to estimate the amount of over dredging that would occur from the CDF[1] material from the pilot study would have to be dredged during the solids removal from the CDF. The existing solids in the CDF altogether is another indication that the alternative being considered was not comprehensively evaluated. Great uncertainty, in the operational parameter values and cost estimate remain. EPA's analysis of this alternative is further compromised by the fact that the methods for handling the existing solids in the CDF and the implications on the treatment system have not been explained.

6.1.4 Over-Dredging

A certain amount of additional solids can be expected to enter the treatment system due to over-dredging. This will be the result of the irregular shape of the "hot spot" area and the inherent nature of dredging projects. Most dredging projects include provision for at least 20% for over-dredging. In the EFS Report #11, the Corps of Engineers recognizes that "dredges cannot precisely cut a given thickness of material." The volume

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[1] See, dredging comments.

dredged to capture the sediments EPA intends to remove is likely to be much greater if they dredge as presented in the HSFS.

6.2 CDF OPERATION

6.2.1 Operating Scheme

The report does not clarify important aspects of how the CDF will be used. The report must indicate whether water effluent flow out of the CDF will be continuous or intermittent. If continuous, the report should address the method for controlling water flow out of the CDF such that suspended solids due to the discharge of sediments into the CDF from the Cutterhead dredge and the dredge operations within the CDF do not overflow from the first cell of the CDF. If intermittent, the report should address the impact of flow surges on reentrainment of solids and on solids settling, and the report should address the adequacy of hydraulic residence time available.

6.2.2 Inlet Flow Diffuser

The report states that a submerged diffuser will be used to control
super ision of turbulence during slurry input into the CDF. The configuration of the diffuser should be presented, and the operating plans for depositing the solids in the CDF while solids

are simultaneously being dredged out of the CDF and supernatant water is being withdrawn from the CDF.

6.2.3. Solids Removal from CDF

The method of solids removal from within the primary and secondary cells were not investigated. Operating controls for sediment removal to avoid high suspended solids in the CDF effluent or excessive solids loading to the water treatment system, poor sludge settling, short circuiting of flow through the CDF, localized buildup of sludge and low solids influent to the sludge dewatering system have not been addressed. Solids generated by settling within the secondary cell of the CDF and as residuals of water treatment should also be addressed.

6.2.4 CDF Retention Time

The report states that 20,000 cubic yards of storage capacity are available in the CDF. Retention time in the CDF is presented as 1-2 days after operation for 80 days, based on accumulation of 189 cubic yards of 20% solids per day. This retention time appears to be calculated based on a 24 hour/day average dredge operation and, furthermore, does not incorporate the hydraulic efficiency factor of 0.23 (dimensionless) presented in EFS Report 7 (Wade, 1988) paragraph 42. We have already requested clarification of the operating procedure in comment B1. The assumed value and rationale for determining the hydraulic efficiency factor used in evaluating the CDF operation should be presented in order that a complete balance of materials flow values may be developed.

6.2.5 Impact of Downstream Operations

The report did not address operational impacts on the CDF resulting from any loss in throughput capacity of the mechanical dewatering facility (e.g. operating performance, mechanical failure). Cost impacts to be addressed should include at a minimum: delayed dredging operations, wastewater treatment requirements resulting from higher solids loading with reduced performance in CDF because of lower retention time, and delayed operation of incineration unit and ash solidification process. An overall system operational and design analysis considering the potential operating ranges of all system parameters.

6.2.6 Solubilization of PCBs in the CDF

Based on data describing PCB solubilities and elutriate test results, the concentration of PCBs in the CDF effluent could range from over 110 ppb to more than 1,000 ppb. This conclusion is based upon the following:

1. Solubilities of PCBs range up to 3,500 ppb.

2. Desorption of PCBs from the "hot spot" sediment into the aqueous phase occurs during dredging and slurry transport. Dredging and pumping the sediment to the CDF as 2 to 3 percent solids in aqueous phase would accelerate the desorption of PCBs from the sediment and promote rapid solubilization. Entrained pools of PCB contaminated oils embedded in the "hot spot" sediment would be dispersed into fine droplets in the slurry and promote liquid phase mass transfer of PCBs from the oil phase into the aqueous phase due to the large increase in the interfacial area of these droplets. Once dissolved in the aqueous phase, reabsorption of PCBs onto sediment in a slurry containing 2 to 3 percent solids would not be a controlling mechanism at the CDF.

6.2.7 Phase Equilibrium in the CDF

A supernatant aqueous phase, a settled sediment (solids) phase and a separate oil phase would exist under the operating conditions of the CDF. The formation of a separate heavy liquid (oil) phase would likely occur in the CDF as follows. Pools of PCB contaminated oils dredged from the "hot spot" sediment would first be dispersed into the slurry as small droplets. The undissolved PCB oils would coalesce and drop to the bottom of the CDF. The rate of settling for these droplets is faster than the rate of reabsorption into the sediment phase. The coalesced oil would therefore form separate pools of PCB oils at the bottom of the CDF. Once formed, the PCB oils would continue to accumulate in the CDF. There is no provision in alternative HS-2 to withdraw and destroy this PCB oil phase. The mechanical filtration (i.e., plate and frame filter) would separate the solid phase only, the filtrate containing the PCB oil phase would be returned to the CDF. Therefore, the oil phase would remain in the CDF. No provision has been made for extraction and treatment of the oil phase.

6.2.8 Air Quality

Volatilization of PCBs from the CDF will occur due to the release of the entrained air from the dredged discharge slurry, the turbulence caused by the introduction of various recycle streams into the CDF, and evaporation of PCB from the water phase. PCB contamination of air under the dynamic operating conditions of the CDF would violate ambient air quality standards. This presents significant environmental impact of implementing the recommended alternative and it is not mentioned or analyzed by EPA. The air quality data collected during the pilot study was not utilized in the development or analysis of alternatives, based on conversations with EPA and Ebasco representatives. Therefore, EPA did not consider the important potential air quality impacts of implementing their recommended alternative, despite going to the effort and expense of conducting the pilot air monitoring program.

6.2.9 Scrubbing Solution Treatment

Scrubbing wastewater from the air pollution control system on the incinerator will be discharged to the CDF. The mass balance indicates that no solids enter the air emission control system based on 10 percent of the feed being combustible and the rate of bottom ash indicated. A realistic estimate of the quantity of fly ash solids should be developed. Furthermore:

a. The accumulation rate of solids in the CDF did not include this material.

b. The fly ash solids will contain heavy metals, metal oxides and hydroxides. There has been no testing of fly ash characteristics, leaching potential for metals, and of effective water treatment for removal of metals prior to discharge.

c. There has been no testing of how addition of scrubbing solution to the CDF will alter treatment system performance, effluent suspended solids and sludge settling performance.

6.2.10 Percolation from CDF

The report addresses impacts resulting from surface runoff leaving the CDF area, but does not address potential impacts of infiltration through the walls and bottom of the impoundment. The CDF is to be the storage area for the PCB-contaminated sediments and is also planned as the permanent storage location for the ash residue from the incinerator, which will contain elevated levels of heavy metals. No analysis of the potential discharge from the CDF is presented in the HSFS. Groundwater data have been collected during and after the pilot dredging program, but the results of the data collection effort are not presented or used in the analysis of alternatives. If the CDF is to be used as a permanent disposal site, the analysis of the groundwater route of transport is critical to mitigating potential environmental impacts.

6.3 MECHANICAL DEWATERING

6.3.1 Sediment Dewatering Process

The conceptual design leaves several operating features for the sediment dewatering process undefined:

a. Storage of dewatered sediment prior to incineration is not addressed. The filter press(es) operate as a batch process, and the incinerator will run continuously. Some storage of dewatered sediment will be necessary to avoid interruption in the operation due to the nature of batch and continuous feed operations. The storage handling should be designed with consideration of operating conditions that are likely but have not been identified by EPA, such as if the filters experience longer cycle times or mechanical failures.

b. Required/available storage capacity is not presented.

c. Control features for run-on/run-off control are not presented.

d. If the temporary storage area for treatment residue is to be used for solidified ash and dewatered sediment, controls for segregation and avoidance of cross-contamination and air emissions should be addressed.

e. The issue of odors and air emissions from accumulated sediment is not addressed. Ebasco (1987) recommended building enclosures for the dewatering and storage areas when initially considering potential air impacts of the elements of the remedial action. Those portions of the alternatives appear to have been eliminated from the alternative as presented in the HSFS without rationale. It appears that the potential air impacts are no longer being considered without justification for their elimination from consideration.

6.3.2 Dewatering Capacity

Bench scale testing of the filter press by O.H. Materials involved processing a slurry of 38 percent solids to a sludge cake with 62 percent solids. Comments on the results include:

a. The flux of water for dewatering from 20% to 50% solids will be three times that for dewatering from 38% to 62% solids. The feasibility study does not address how equipment sizing and operating costs for dewatering were adjusted to accommodate this. Furthermore, if the influent sediment solids content drops to 15% solids, the water flux will have to be over five times that in the bench scale test. No sensitivity considerations relative to operating parameters of the dewatering system appear to have been made.

b. The characteristics of the slurry that was tested would be substantially different from those expected operating conditions. This raises questions as to whether the sample is representative (e.g. distribution of grain sizes) and, therefore, the validity of the testing data for application in the design.

c. There was no analytical data presented to analyze the material balance for PCBs through the dewatering step.

d. The test report indicates that a 50% volume reduction can be expected. The design condition represents a volume reduction of about 70% (i.e. 61 cy cake per 204 cy sediment). The feasibility study should present how this data was incorporated into the design and whether the 50% reduction in volume was interpreted as a claim for 50% solids content.

e. If the achieved solids content in dewatered sediment is only 45%, the amount of water entering the incinerator will be 22% greater than the design case (i.e. an additional 8 tons water per day), and if solids content is only 40% there will be 50% more water than under assumed design conditions. Additional water content entering the incinerator has a dramatic impact on operating cost, as that water will be evaporated. Sensitivity of energy consumption in the incinerator to performance of the dewatering unit should be addressed in the feasibility study, particularly as it relates to incinerator performance and the operational costs.

The O.H. Materials pilot study appeared to be inadequate based on the very limited documentation that was provided. The dewatering is a critical element to the recommended alternative. An extremely brief report on the pilot test was provided. It did not appear to consider the variations in sediment characteristics over many of the different operating conditions that may be encountered. EPA conducted more exhaustive pilot tests on alternatives that were rejected on the basis that they had not been implemented previously. Similar efforts should have been made to test dewatering which is a critical element of an alternative whose selection was virtually guaranteed by the process they were going through.

6.3.3 Sediment Conditioning

No mention was made in the feasibility study of conditioning of settled sediment from the CDF prior to mechanical dewatering. The bench scale test involved addition of lime at the rate of about 28 pounds per ton of dry solids.

a. There is no mention of sediment conditioning in the HSFS.

b. The actual dosage for sediment conditioning remains to be determined for the design condition.

c. Chemical addition of lime adds solids to the process that will increase the volume of feed into the incinerator and downstream processing.

d. The limitation of particle size for material handling equipment is not addressed as a concern in the report. Screening of solids with nominal size greater than 0.5 to 1 inch will be necessary unless special equipment is being considered.

6.4 WATER TREATMENT

6.4.1 System Loading

6.4.1.1 Flow

a. The mode of operation for the water treatment system is not specified as to whether flow from the CDF secondary cell will be 24 hours per day or intermittent with dredging operations.

b. Bulking of sediment during dredging may have a substantial impact on the rate of water treatment required. The HSFS does not address what safety factor has been incorporated into the conceptual sizing of the system for variable flow conditions.

c. The rate of flow for scrubbing solution is not included in the FS material balance.

6.4.1.2 Soluble PCBs

The extent of solubilization of PCBs in the CDF has not been determined. Solubility limits for PCBs range from 2.7 ppb to 3,500 ppb. The operating conditions of the CDF are such that it promotes solubilization of PCBs. Therefore, the size of the water treatment system could increase substantially and severely impact treatability of the CDF effluent, PCB residuals from the treatment process, and performance of the treatment system.

6.4.1.3 Metals

The incinerator scrubber effluent containing incinerator fly ash is to be recycled to the CDF. This will increase the loading of suspended solids to the water treatment system. The fly ash will contain heavy metals (cadmium, copper, lead, chromium, etc.). The removal of heavy metals would present a problem in the water treatment system which is primarily designed to remove PCBs. The metal hydroxides present stay dissolved unless the pH is adjusted to at least 9.0 Standard Units for the entire effluent. The cost associated with a metals removal system is not included in the total remedial cost estimate, but the impact of discharging such metals to the estuary does not seem to have been conducted either.

Addition of scrubbing wastewater to the CDF will result in higher concentrations of dissolved metals passing to the water treatment system. The scrubbing solution will probably be alkaline, but when the solution is mixed in the CDF there will be greater potential for metals to leach from the fine fly ash solids.

6.4.2 Chemical Addition

6.4.2.1 Removal of Suspended Solids

a. Chemical addition at the overflow weir from the primary CDF cell relies on mixing intensity provided by the fall of water over the weir. Chemical addition works well in steady state operation. The HSFS does not address the impacts of daily startup and shutdown of flow through the CDF.

b. Based on comments made on CDF operation, the amount of suspended solids entering the secondary CDF cell may vary. There appear to be no controls for chemical addition to react to upsets in the primary cell.

6.4.2.2 Removal of Metals

a. There has been no testing conducted to determine what concentrations of metals may be expected in the water treatment system, nor to confirm chemical addition or processing for removal of the metals.

b. Chemical addition for removal of metals should be considered in the overall process material balance.

6.4.3 Clarification

6.4.3.1 Residence Time

a. The HSFS does not specify the available volume and residence time in the secondary cell of the CDF. Based on settling tests, USACE recommends an actual residence time of 150 minutes. Whether there will be adequate retention time based on projected flows during the 4 hour period of dredging is not certain.

b. Accumulation and removal of settled sludge from the secondary cell of the CDF are not addressed in the HSFS. Sludge storage volume should be considered when determining available residence time. The method of removing and the necessity for treatment of accumulated sludge should be addressed. The sludge in the secondary cell could contain elevated levels of PCBs and heavy metals from the primary CDF cell, the dewatering water and the incinerator discharge sources. A material balance relative to expected capacity of the cell and the need for sludge treatment should be provided.

6.4.3.2 Sludge Volume

a. Settled sludge consistency with chemical addition for removal of metals is not presented. Settled sludge consistency in USACE tests was 5 to 10 percent for flocculation of suspended solids.

b. Sludge from metal precipitation (i.e. metal hydroxides) are typically more difficult to dewater to 50% solids. Plans for processing sludge from water treatment needs to be addressed in the HSFS.

6.5 FILTRATION/CARBON ADSORPTION

6.5.1 Filtration Method

Although pilot testing of sand filters was conducted, the HSFS relies on further testing to confirm whether multimedia or microfilters will be used. There is no development in the HSFS of what design basis is used for filtration of colloidal material, which leaves significant uncertainty in the engineering cost estimate.

6.5.2 Filter Backwash

Solids removed during filtration will need to be processed. The HSFS does not address handling of these residuals, the source and/or storage of backwash water, hydraulic impacts on other process units, or what redundancy or excess capacity is available to accommodate higher solids loadings resulting from an upset in the CDF secondary cell.

6.5.3 Carbon Filtration

According to Averett, 1989, carbon adsorption isotherms indicate that carbon adsorption is a relatively inefficient process for treatment of the wastewater. There has been limited testing of alternative technologies for PCB removal performed to date, particularly of water resembling that expected from the recommended system. The following comments relate to the carbon system:

a. Elutriate Testing. The following elutriate test results, obtained by the USACE, represent likely conditions with dredging of sediments as they are placed in the CDF.

		PCB Concentrations (ppb)	
	PCB Content (ppm)	Standard Elutriate Test Total/Dissolved	Modified Elutriate Test Total/Dissolved
Pilot Sediments	100+/-	not tested	not tested
Estuary Sediment	2,170	230 / 120	220 / 110
"Hot Spot" Sediment	7,680	2,890 / 550	1,200 / 460

Design Basis. The HSFS refers to analysis of effluent concentrations leaving the CDF during the pilot test that indicated that 12.1 ppb PCBs would enter the filtration and carrbon adsorption treatment system, 1.4 ppb dissolved PCBs and 10.7 ppb associated with suspended solids.

There was no elutriate test data on the pilot test sediments for direct comparison to the HS operation through the elutriate tests. Comparison of available data indicates that the concentrations of PCBs in the pilot test sediments are an order of magnitude lower than those in the HS sediments, as is the concentration of PCBs in the effluent relative to the elutriate test result. There appears to be no basis to assume for the design, as EPA did, that the concentration of PCB in the effluent of the CDF will be anything less than the "hot spot" elutriate test concentration.

Impact on Feasibility. The HSFS assumes a PCB loading on the carbon adsorption system that is too low. Carbon usage is directly related to PCB loading. The HSFS should address sensitivity of cost for carbon treatment to PCB loading.

b. The effectiveness of carbon adsorption units is often related to the available contact time for PCBs to be captured on the carbon. The flow rate of 2,875 GPM (i.e. 690,000 gallons in 4 hours) will require a large bed volume of carbon to provide the 30 to 40 minutes of empty bed contact time often required. The HSFS does not include the design assumption for the empty bed contact time nor the cost sensitivity for greater vessel sizing and carbon required.

c. The method of carbon disposal was not clearly presented nor were operational considerations for carbon replacement developed in the HSFS.

6.6 INCINERATION

6.6.1 Capacity

The throughput of the incinerator is highly dependent on the moisture content of the cake. The solids content of the cake can vary from 20 percent (when the plate and frame filter press fails) to approximately 50 percent. Moisture breakthrough in the filter adversely affects the capacity of the incinerator. It is not clear if such an operational eventuality is accounted for in the operating cost estimate for the incinerator.

6.6.2. Solids Handling

a. It is not certain what provisions are made for the incinerator feed cake to avoid PCB volatilization, due to atmospheric contact, to eliminate dust problems, and to avoid rainfall and rehydration.

b. Proper conveyance of soils feed to the incinerator has proven to be a difficult step in the solids incineration process. Conveyance of "hot spot" sediment cake has not been demonstrated. This could impact down time of the incinerator.

6.6.3 Operational Concerns

6.6.3.1 Corrosion

Organic chloride (from PCBs) will be converted to hydrochloric acid (HCl) in the combustion process. Organic bromine (present in the salt water sediment) and bromine salts present in the saline waters will be converted to HBr and Br_2, while fluorine is converted to hydrofluoric acid (HF). These gases are extremely corrosive in the scrubber systems, resulting in frequent prolonged system shutdowns.

6.3.3.2 Fouling

The low fusion temperatures of alkali metal salts lead to extreme fouling problems on the heat transfer surfaces. These fouling problems are so acute that the economics of the incineration process will be compromised by excessive down time for heat transfer surface cleaning.

It is not apparent that these issues have been considered in the evaluation of the incineration alternative for this site. EPA and their consultant's preoccupation with the development and justification of a dredging and incineration alternative has resulted in their consistent reliance on the fact that "incineration is a proven and demonstrated technology" to justify its implementation in New Bedford Harbor. In reality, it is a very complex treatment system that has numerous site-specific aspects to be considered relative to the feasibility of implementation. A blanket statement to the effect that it has been done elsewhere, therefore, it can be done here, is not adequate to demonstrate that the site-specific considerations have been adequately addressed and that the feasibility of implementation at this site has been demonstrated.

6.6.4 Feasibility

a. There has been no bench scale testing of incineration to generate data on sediment combustion characteristics, ash content, or potential air emissions.

b. Equipment rental is proposed for alternative HS-2. It is possible that system bugs and breakdown may cause lengthy delays in achieving remediation targets. It is not clear that equipment availability beyond the projected timing has been considered or that the cost contingency will cover the additional expense.

6.6.5 Fuel Supply

a. There is no discussion of provisions for fuel supply, storage and management at the site. The quantity of fuel required will be substantial. There is no consideration of fuel supply reliability, off-loading or pipeline facilities, or contingency for cost fluctuations with variable market conditions. The potential environmental impacts of fuel handling and storage have not been addressed.

b. Reduction in solids content to 45% solids will result in an additional fuel requirement of about 12,000 gallons of #2 fuel oil per day to handle the additional water. The handling and storage systems must be designed with appropriate contingencies of the prepared treatment system in mind.

6.6.6. Process Volume

The cost estimate for incineration of dewatered sediment is based on processing 12,240 tons of sediment at 50% solids. The quantity of dry solids does not include the 6,500 cubic yards of sediment currently in the CDF from the pilot test.

6.7 AIR POLLUTION CONTROL

6.7.1 Process

There has been no testing of fly ash or air emissions to develop test data for selection of the air emission control system. The report assumes that 10 percent of incoming solids are combustible. The mass balance for solids on the incineration system indicates no solids whatsoever will enter the air pollution control system. There is no indication of what fraction of solids is expected to be emitted, returned to the CDF with the scrubber water or collected as dry fly ash solids.

6.7.2 Volatile Emissions

The effect of volatile toxic metal emissions on ambient air quality should be evaluated.

6.7.3 Solids Handling

6.7.3.1 Chemical Storage

Chemicals will be required for scrubbing towers or venturi scrubbers as considered in the FS. Chemical storage is not completely addressed in the report from operational or contingency points of view.

6.7.3.2 Fly Ash

Handling of fly ash from dry precipitators or baghouses is not described in any detail. Worker safety concerns should be addressed in addition to factors such as fugitive emissions, dust control, leachate/run-off control.

6.8 SOLIDIFICATION OF ASH

6.8.1 Database

There has been no testing conducted to verify the performance of solidification on incinerator ash from processing of New Bedford Harbor sediments. Solidification testing referred to in the HSFS was that conducted on unprocessed sediments, not incinerator ash. The technology has not been tested on the ash. If it does not work and the ash is classified as hazardous, disposal will include transportation through the community and disposal at a cost of at least 20 times that estimated.

6.8.2 Stabilization of Metals

The HSFS notes that stabilization of nickel and copper was not demonstrated in the testing of solidified sediments. There is uncertainty in the ability to process the ash by stabilization within the unit costs used in the estimates.

E.C. Jordan personnel have stated at a public hearing that they do not know of a formulation that will stabilize the metals at this time. They plan to search for such a formulation during the design stage. Obviously, the cost of such a formulation could not be considered during the HSFS and the limited cost presented for the ash disposal is likely to be only a small percentage of the realized cost during full-scale implementation. The disposal of the ash is a critical element of the overall treatment system and the disposition of the final end product should be reconciled prior to the recommendation and design of an overall remedial action system.

6.8.3 Treatment Volume

The cost estimate reflects solidification of 3,580 cubic yards of ash. This quantity is based on processing only the 10,000 cubic yards of "hot spot" sediments and does not include the additional 6,500 cubic yards of solids in the CDF from pilot work or any allowance for over-dredging.

6.9 COST IMPACTS

The following is a partial list of items for which it is not clear that costs were included in the HSFS estimate or for which the cost analysis was incomplete for the incineration alternative:

1. Screening of oversized solids before mechanical dewatering.

2. Excess capacity in solids filters to handle upsets and variable performance in the CDF.

3. Chemical storage facilities and operating costs for chemical addition:

   a. to remove metals from wastewater
   b. to condition sludge for dewatering

4. Operating expense to dewater and process sludge from water treatment system, particularly if removal of metals is necessary.

5. Adequate quantity of activated carbon in the water treatment system for removal of PCBs, based on underestimation of PCB loading on filters, and operating expense for disposal.

6. Equipment and operating expenses for removal of solids from CDF primary and secondary cells.

7. The cost estimates for secondary dewatering and handling of dewatered sediments do not account for the 6,500

cubic yards of solids already in the CDF from pilot operations. The additional solids would increase direct costs for dewatering alone by close to $450,000, based on the presented unit costs.

8. Adequate processing capacity in mechanical dewatering to handle incoming sludge at 15 to 20 percent solids, since sizing was based on testing with sludge with a solids content of 38 percent.

9. Increased operating expense for longer cycle times to process sludge quantity based on limitation of water flux rate.

10. Storage facilities for dewatered sludge including controls for runoff, leachate, odors and fugitive emissions.

11. The cost estimates for incineration of dewatered sediments do not account for the 6,500 cubic yards of solids already in the CDF from pilot operations. The additional solids would increase direct costs for incineration by as much as $1,500,000, based on presented unit costs.

12. Incineration system sizing to accommodate additional

moisture content in dewatered solids and maintain design processing rate for dry solids.

13. Fuel delivery and storage facilities.

14. Allowance for additional fuel if dewatering does not achieve 50% solids and contingency for market fluctuations in pricing.

15. The cost estimates for solidification of incinerator ash do not account for the 6,500 cubic yards of solids already in the CDF from pilot operations. The additional solids would increase direct costs for solidification by approximately $220,000, based on presented unit costs.

16. The cost of the formulation that would actually be utilized for the solidification of incinerator ash. A limited allocation was made in the HSFS. It is likely that the unit cost will be significantly higher than that assumed based on the need for some specialized formulation if one can be identified.

17. Disposal of flyash as hazardous waste if solidification cannot meet treatment standards. This could result in

an additional cost of $5 million to $10 million for the ash disposal alone.

18. Greater quantity of solids for processing through the CDF, dewatering, incineration and solidification because of low estimate of in-situ sediment moisture content. This will involve additional factor of 30 percent on costs for all steps. In the sensitivity analysis, the HSFS considered that the accuracy of the volume estimate could underestimate the amount to be dredged by as much as 20 percent.

    Overall, the net increase in total dry solids input will be 83 percent over the design case considering: additional solids in CDF; a practical estimate of sediment moisture content; and accuracy in dredging limits. Costs for each processing step will increase proportionately, which, not counting other factors, would increase the cost estimate to roughly $21 million. Applying the differential in incineration costs considered in the HSFS, the cost will range to $25.5 million.

19. Utilities and services to process:

    o Electrical substation and transmission systems

- Electrical motor control room
- City water storage
- Fire water and deluge system
- Air compressor and compressed air system
- Central control room
- Quality control laboratory
- Employee lunch room - washrooms
- Standby fire fighting equipment

20. The amount of influent dredge materials was assumed to be precisely 10,000 cubic yards. As discussed elsewhere in these comments, the probability that greater amounts of sediment will be dredged is a virtual certainty, due to the uncertain definition of the actual hot spot area and the nature of implementing dredging programs in the field which results in over dredging to accommodate the collection of the sediments from the target area. We would expect a minimum of 20 percent over-dredging which would essentially add 20 percent onto all dredging and treatment related costs in the alternative.

EPA, in developing its cost estimate, used a series of optimistic assumptions relative to the system characteristics and operating parameter values. In addition, numerous cost items, as listed above, were not considered or realistic ranges were not evaluated. In addition, some potentially

significant cost items, such as the cost associated with air quality controls or treatment of metals in water prior to discharge, have not been evaluated and could add significantly to the cost, both capital and operating, of the alternative. A realistic sensitivity analysis and cost analysis of the system has not been prepared.
As a result, the estimated cost of implementation is significantly underestimated and the system conceptualization may be faulty.

6.10 OPERABILITY

The incineration alternative includes a multitude of unit operations, some of which are continuous and others batch processes. There is a high degree of reliance in the HSFS on consistent steady operating conditions and unit performance for the system to reliably function within the projected operating schedule. Several elements of the proposed alternative have not been tested in the laboratory or on pilot scale at this point, yet the contingency allowance is only 20 percent.

6.11 SUMMARY

In its effort to bring about a quick resolution to a complex problem, the EPA has made a hasty recommendation to dredge and incinerate the hot spot sediment without due consideration of the associated air pollution and water quality issues. Also, there are major site specific questions that must be answered prior to the selection of the alternative. Other alternatives for remedial action have been ruled out from consideration simply because they have not been implemented on other sites. Incineration, though implemented on other sites, is not a proven technology ready to be implemented at New Bedford. The treatment system that is recommended is a highly site-specific system. It has not been demonstrated for the field conditions anticipated at New Bedford Harbor. The conceptual design of the system presented in the HSFS contains many areas of uncertainty and will result in the implementation of an alternative that will be inefficient, will be operating over an extended period of time, will have adverse environmental impacts and will cost at least twice what of EPA estimated.

In the HSFS, many assumptions on operating conditions have been made. In most cases an optimistic approach has been adopted in the assumption of operating conditions and parameter values. A sensitivity analysis with realistic values and value ranges, including a worst case situation should be conducted to comprehensively analyze the feasibility and potential cost of the recommended alternative. Without such an analysis, the true feasibility, implementability and costs are unknown. Significant elements of the proposed remedial action system have not been studied; particularly the disposition of the incinerator ash. EPA recognizes that a feasible and reliable treatment system for the ash has not been identified at this time. This could result in an additional $5 million to $10 million for ash disposal alone.

Numerous items have been listed for which the potential costs have not been evaluated in the HSFS. When these potential impacts on the cost are combined and the impacts compounded through the recommended system, it is demonstrated that the potential cost of the system could exceed $30 or $40 million.

When originally presenting the operable unit concept to the public, Frank Ciavattieri of EPA stated that one of the important criteria for deciding to adopt an operable unit was the fact that it would cost less than $30 million. It is apparent that EPA has not demonstrated that this alternative is definitely <u>not</u> a $30 million plus solution, solely based on the fact that the ash disposal issue has not been determined and many other details of the system have not been studied to a sufficient level of certainty to justify the cost assumptions made. The cost estimate in the HSFS has a mere 20 percent contingency in it. A review of EPA's prior FS cost estimates versus remedial action implementation costs would reveal that a 20 percent contingency at this stage is unrealistically low. Utilizing an appropriate contingency factor would add millions of dollars to the cost estimate.

EPA's analysis of the proposed remedial action alternative needs to be more comprehensive in order that it can be demonstrated that the system is feasible and cost-effective for New Bedford Harbor and that it is superior to other alternatives. Appropriate ranges for operating conditions and parameter values must be considered, along with the compounding implications of deviations from the conditions assumed in the HSFS. Therefore, we conclude that the presented cost estimate for the alternative is not reliable as it involves many unknown factors that adversely affect the outcome. All of the evaluation criteria, most importantly feasibility, operability, environmental impacts and costs, should be reevaluated for all of the alternatives in order that an appropriate alternative will result in an environmentally sound and cost-effective remedial action.

CONTRIBUTORS

Rizzo Associates, Inc.
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7.0 OTHER COMMENTS ON THE HSFS

7.1 INTRODUCTION

In addition to a detailed discussion of sections of the Hot Spot Feasibility Study (HSFS), the defendants are submitting the following specific comments on the following issues:

(1) The lack of a quantitative assessment of the impact of the proposed remediation both on PCB flux and on health risks.

(2) The lack of adequate data demonstrating health and ecological risks from the PCB sediment and water concentrations.

(3) The lack of consideration of risks caused by factors other than PCBs, both in the evaluation of current conditions and in evaluating risks during and following remediation.

(4) The arbitrary nature of the selected hot spot remedial target PCB concentration.

(5) The inconsistent evaluation of the remedial alternatives.

(6) The uncertainties in cost estimation caused by uncertainties in input parameter values.

These issues are discussed following the organization of the HSFS.

7.2 COMMENTS ON THE EXECUTIVE SUMMARY

7.2.1 The goals and objectives of the HSFS are unclear. The stated goal for the overall Feasibility Study is "to present EPA with a range of remedial alternatives to address the cleanup of PCBs and metals in New Bedford Harbor." However, the overall remedial goals for the Harbor cleanup have not been determined, so it is unclear how the "hot spot" operable unit will achieve the overall goals (which have not been set).

7.2.2 The summary stresses coordination of the "hot spot" cleanup with overall remediation goals, yet this issue is totally ignored in the detailed evaluations in the HSFS.

7.2.3 The HSFS states that EPA conducted a detailed analysis of dredging alternatives in response to comments on an earlier Feasibility Study; however, in this document the focus is on dredging only, at the expense of other potentially feasible alternatives. In the end, these other alternatives are eliminated because there is insufficient data for a valid analysis due to the focus on dredging alternatives during the pilot and bench-scale studies.

7.2.4 The definition of the "hot spot" area as all areas where sediment PCB concentrations exceed 4,000 ppm is arbitrary and subjective. According to the HSFS, this limit is "not risk-based" but selected as a minimum volume of sediment containing the maximum PCB mass." A more accurate analysis of harbor PCB volume and mass ratios shows that the point of diminishing return occurs at about 10,000 ppm.

7.2.5 The location of the "hot spot" as defined in the HSFS differs substantially from that delineated in an earlier study. Resolving the location is critical both to remediation of the "right" area, given EPA's criteria, and to an accurate determination of the volume to be remediated.

7.3 COMMENTS ON THE INTRODUCTION

7.3.1 Despite the emphasis in the report on justifying the "hot spot" as an operable unit, no significant analysis is presented to justify the contention that "the remedial alternative selected for the 'hot spot' area will be consistent with a remedial strategy selected for the overall site." As stated earlier, since the overall strategy has not been selected it is impossible to predict that the selected strategy for the "hot spot" operable unit will be consistent with the overall strategy unless the strategy selected for the final cleanup is based on that selected for the operable unit.

7.3.2 The magnitude of risk reduction from a cleanup of the "hot spot" has not been computed. Therefore, it is uncertain if the risk will be reduced or enlarged by implementation of the recommended plan.

7.3.3 The HSFS states that the Harbor was closed to fishing due to PCBs, but does not mention the sewage overflows into the harbor which may have a more immediate and serious health effect on use of the harbor.

7.4 SITE DESCRIPTION

7.4.1 The definition of the "hot spot" is arbitrary, based, according to the HSFS, on a "common sense" level. This implies a universally accepted standard for clean-up. No criteria for selection are presented, although 4,000 ppm is cited as an "optimization" value. In fact, the point of diminishing return demonstrated by Table 2-1 in the report appears to occur at about 10,000 ppm.

On the basis of a simple calculation of PCB mass removed divided by the volume required to be treated, the incremental reduction from the 30,000 to 20,000 ppm target level compared to the 20,000 ppm to 10,000 ppm is reduced by more than one half. The incremental benefit in treating at increasingly lower target levels continues to decline.

There is no clear "optimum" target level. In general, as the target level declines, the volume of sediments which must be remediated for each % of PCB mass removed continues to increase. The exception is at a target level between 10,000 ppm and 9,000 ppm where the ratio of % PCB mass removed to volume remediated increases.

Figure 3 also suggests that a target level of 9,000 or 10,000 ppm is more appropriate than the proposed 4,000 ppm level as the ratio of percent mass removed to volume of sediment removed is at a local maximum point.

7.4.3 PCB concentration maps presented are estimated as accurate to within 15 percent, indicating that volume estimates are accurate to 15 percent at best. However, this uncertainty is not carried through to other sections, particularly the cost estimate sections where the remediation alternatives' costs are based on estimated volume. Since there is also significant uncertainty in the individual unit costs for elements of the remedial action alternatives, the EPA cost estimate contingency of 20 percent is much too low.

7.4.4 PAH contamination caused by sources other than the defendants has been identified by the government and dismissed because of "relatively low levels."

EPA's statement is in error since PAHs are ten times the level that occurs in most urban estuaries.

7.4.5 An outlier concentration of 249,000 ppm is arbitrarily reported with the implication that it is representative of the data set, although it is, in fact, an outlier.

7.4.6 The "hot spot" area is called depositional. Dredging is not necessary to mitigate contamination in a depositional environment which is suited to in-place containment and/or biodegradation.

7.4.8 The statement on p.2-18/19 that the Brown and Wagner study (1986) shows no consistent pattern of sedimentation between 5-7.5 cm and 15-17.5 cm depth is incorrect. The actual study does not mention sedimentation, but states that the similarity between the 5-7.5 and 15-17.5 cm specimens at each site suggests vertical diffusion of both oils and Aroclors.

7.4.9 Contrary to the statement in the report that other reports have identified PCB concentrations in the surface layers as equal to subsurface concentrations, and despite cessation of PCB release and continued sedimentation, there is significant evidence to suggest that PCB concentrations are low at the surface, increase with depth, reach a maximum and decrease again as depth increases. The following studies provide examples that, contrary to the p. 2-18/19 HSFS statement, there is a basis for expecting that natural deposition of clean sediment can effectively cover or dilute the contaminated surface sediments:

7.4.9.1 Metcalf & Eddy's (1983) summary of previous sampling data showed that PCB levels there were highest at "shallow" (4-8 cm) depths, and lower at the "surface" (0-4 cm), and in the "deep" (>8 cm) layers.

7.4.9.2 Balsam's (1989) thin layer PCB sediment analysis from cores collected near the "hot spot" (site FX) and in the cove adjacent to the CAD site (DR) show maximum PCB sediment concentration at depths of 7-10 cm. For the site near the "hot spot" (FX) the near surface PCB concentration is a factor of 6 lower than the peak value located at a depth of 10 cm.

7.4.9.3 Brownawell (1986) sediment PCB concentration data at site 84 (mid Harbor) shows a peak concentration at about 14 cm depth. This peak is approximately 30 % larger than the concentration in the 0-4 cm section of the sediment.

7.4.9.10 Despite the recognition is this section of the HSFS anaerobic biodegradation is occurring in New Bedford Harbor, no attempt is made to take advantage of this natural process in the design of the recommended remedial alternatives, despite recommendations by EPA's own experts.

EPA's staff (Lake, et al. August 30, 1989) found that in situ biodegradation and PCB dechlorination are occurring in the harbor and in the "hot spot" area. They also conclude that the potentially toxic congeners appear to be among those congeners most readily dechlorinated in New Bedford Harbor and that the dechlorination processes may have decreased potential toxicity of the PCB residues. As a result, Lake, et al. recommend as part of an assessment of remediation options, additional studies to determine the rates of the dechlorination process to allow predictions of the types and quantities of PCBs which will be present in the future. Evidence that biodegradation held great promise for this site has been available for years but, EPA arbitrarily failed to incorporate this information in evaluating alternatives prior to the publication of the Feasibility Study.

Further, Radian Corporation in their report "Bench-Scale Testing of Biodegradation Technologies for PCBs in New Bedford Harbor (MA) Sediments," prepared by Radian Corporation for Ebasco Services, Inc., June 2, 1989, recommended that anaerobic biodegradation be evaluated as an alternative for the dechlorination of PCB-contaminated sediments. This recommendation was also ignored.

7.4.9.11 Thibodeaux's (1989b) recent work sponsored by the U.S. Army Corps of Engineers is not referenced in the discussion on volatilization, despite the fact that he showed that evaporative processes account for about 40 percent of the loss of PCBs from the upper estuary. Failure to acknowledge this information is further evidence that EPA failed to adequately evaluate short-term and long-term risks of the remedial alternative involving dredging.

7.4.9.12 The HSFS asserts that the "hot spot" areas correspond to the locations of the stormwater and combined sewer outfalls, but no evidence supporting this assertion is presented.

7.4.9.13 The discussion of vertical migration of PCBs ignores migration deeper into the sediments, the role of sedimentation and partitioning of PCBs onto these freshly deposited sediments, and biodegradation.

7.4.9.14 Even considering the effect of diffusion and bioturbation mechanisms, natural sedimentation will eventually result in decreased PCB surface concentrations. This decrease in concentration in the surface layer is not inconsistent with the homogenizing effect of bioturbation, since the majority of the bioturbation occurs near the surface and a continual source or input of clean sediment acts to eventually 'dilute' the concentration at the surface.

7.4.9.15 The summary of the transport section of the HSFS (p. 2-22) states that it is not possible to determine the relative contribution of all of the transport mechanisms that are occurring, but that since the "hot spot" is known to be discrete areas of high PCB concentrations, removing this mass will reduce the mass of material subject to migration by 48 percent, so that such removal is a logical first step in the remediation of New Bedford Harbor. Effectively, the HSFS admits that no real analysis has been conducted, although a thorough and defensible study should provide "a quantitative assessment, with associated uncertainties, to estimate the change in PCB flux from the upper estuary sediments to the water column and how remediation of the "hot spot" will affect the total flux."

7.4.9.16 On p. 2-24, the HSFS reports that the total mean water concentration of PCBs in the vicinity of the "hot spot" is 13,754 ng/l (13.754 ppb). The actual data collected by Batelle (1987) show a mean concentration of 4 ppb.

7.4.9.17 The discussion on p. 2-24 of the depletion shifts in congener distributions demonstrated by Myers (1989) which result from various chemical and physical processes implies that the data Brown and Wagner (1986) present as evidence of dechlorination may have other interpretations. Brown's technique allows him to distinguish between congener distribution patterns due to dechlorination and other processes including aerobic biodegradation. Thus, Brown's data can only be interpreted as biologically mediated reductive dechlorination.

7.4.9.18 The HSFS incorrectly equates biodegradation and dechlorination processes. The term "biodegradation" should be reserved for metabolism of PCBs to non-PCB end products. Biological dechlorination, on the other hand, selectively removes meta and para chlorines, so it has the potential to produce less toxic PCBs according to Lake et al., 1989.

7.5 COMMENTS ON THE BASELINE PUBLIC HEALTH AND ENVIRONMENTAL RISK ASSESSMENT SECTION

7.5.1 A critical issue which has been overlooked in the HSFS is the assessment of public health risks due from fecal coliform to the combined sewer overflows into the upper estuary.

7.5.2 Extremely high carcinogenic risks are predicted in Table 3-1 of the HSFS for existing conditions. However, exhaustive public health studies in the immediate area and others throughout the State have not shown an unusual incidence of cancer in this area. The predictions are also not based on information consistent with physical observation. Thus, the predictions in the risk assessment are inaccurate due to the assumptions utilized in the risk assessment preparation.

7.5.3 The HSFS states that PCBs and metals in the surface water do not result in significant contamination exposure and that the risk assessment is based primarily on exposure due to direct contact with sediments. Since dredging would increase the concentrations in the surface water, it is possible that this would create unacceptable public health risks if EPA assumptions regarding PCB toxicity were correct, a point that defendants disagree with. Other alternatives could mitigate the risks of direct contact without increasing surface water concentrations.

7.5.4 EPA officials indicated in a letter to defendants dated September 19, 1989 that its decision in the HSFS will not be based on the environmental risk assessment, despite some references and representations in the draft HSFS. (Letter from

Charles Bering to Defendants dated September 19, 1989.) EPA also states the environmental risk assessment is not complete. Id. Defendants' comments on government studies in the Administrative Record on which the ecological risk assessment presumably is based according to Ebasco's Progress Reports include:

- o Hanson's reported toxicities from sediment studies must be evaluated as toxicities due to all the toxic contaminants in the sediments, not just the PCBs.

- o Review of the Hansen et al. study indicated that the results of these toxicity experiments could have been confounded by a variety of factors relating to experimental design and laboratory controls. These factors include:

    1. The PCB was introduced to the experiment in a "carrier", either polyethylene glycol or acetone, which has the effect of delivering higher levels of PCB to an organism than is possible in the natural habitat;

    2. Failure appropriately to control for other contaminants, e.g., PAH, which may have been present in the sediment;

    3. Use of an appropriate experimental design and statistical test to differentiate the effects of PCB as compared to metals;

    4. Potential failure to control temperature and salinity during tests, and;

    5. The methodology used to measure water concentrations of PCB raises a number of questions as to exactly what concentrations the test organisms were exposed to.

    - o The proposed water treatment discharge concentration criteria for the remedial action would raise the concentrations of water column PCBs as much a 25 percent during the remedial work.

- o The Capuzzo and Black studies were correlational studies which did not isolate PCBs as the only factor capable of producing the reported results. Both studies are unpublished results which have not passed peer review.

- The U.S. Army Corps of Engineers Study of the Infaunal Community of New Bedford Harbor is discussed in great detail. It is so flawed, and yet so important to the government's conclusions (as it seems to be the only faunal inventory available of the upper estuary) that detailed criticism of it is in order. The statement in the USACE study that "a study of benthic populations in the harbor indicated impaired community structure in the upper estuary," is an assertion that is not scientifically substantiated by the cited study.

- The statement in HSFS that "demersal organisms are effectively precluded from living in the area" is wrong, since the USACE study showed the "hot spot" region to have one of the highest densities of living organisms in the estuary.

- Further, the discussion of ecological risks from transport of PCBs as a function of the amount of sediment exposed and the concentration in the sediment in the HSFS ignores all the factors affecting environmental fate as well as the concentrations of receptor organisms available.

7.5.5 The HSFS statement that "pore water PCB concentrations in sediment are highly toxic to at least some members of all major taxonomic groups occurring in New Bedford Harbor" is supported only by the methodology discussed in the draft EPA guidance document on sediment quality criteria (SQC) and as documented by bioassays on amphipods and sheepshead minnows conducted by Hanson. The methodology utilized in the SQC calculations is at best only a guideline. EPA's Science Advisory Board also stated that SQC should not be used as the basis for specific remedial decisions. <u>See</u>, <u>Inside EPA</u>, (Sept. 9, 1989, p. 14).

7.5.6 On Page 3-3 the HSFS states: "limited data were available to assess risks associated with inhalation exposure to PCBs." EPA collected air quality data throughout the pilot dredging program. These data could have been used to evaluate the potential inhalation exposure due to background conditions, as well as implementation of the recommended alternative; however, EPA rushed forward with the Feasibility Study, prior to the availability of the air quality information.

On page 17 at Appendix D, EPA states that 98.7% of the New Bedford residents have serum levels of greater than 30 ppb. This is incorrect: 98.7% of the New Bedford residents have serum levels <u>less</u> than 30 ppb.

7.6 COMMENTS ON IDENTIFICATION OF REMEDIAL ACTION OBJECTIVES, APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS, AND GENERAL RESPONSE ACTIONS

7.6.1 Two bullet items included in the remedial alternative development and evaluation process include: (1) the identification of the nature and extent of the contamination and the related threat and (2) identification of response objectives for remediation.

With respect to the first bullet, EPA has failed to delineate the nature and extent of the threat. In fact, EPA acknowledges that the definition of the "hot spot" was not risk-based. The exact nature and purpose for "risk assessment" tables throughout the document is, therefore, unclear.

With respect to the second bullet, response objectives for the site are not provided in quantitative terms in the draft HSFS. Therefore, meeting the objectives with a remedial response is not possible. As a result, EPA has violated its own operable unit guidance for the conduct of interim remedies on the basis of operable units.

7.6.2 Capping or biodegradation would satisfy each of the remedial action response objectives listed in Section 4.3.

7.7 COMMENTS ON IDENTIFICATION, SCREENING, AND EVALUATION OF TECHNOLOGIES

7.7.1 Despite earlier representations by government officials, pilot study results for sediment resuspension were directly extrapolated to the "hot spot" to obtain a PCB flux estimation of over one kilogram per day. Direct extrapolation of these results is not appropriate due to the significant difference in physical conditions at the two locations.

For the purpose of pointing up the arbitrary inconsistencies in the HSFS, it should also be noted that in the HSFS EPA has estimated that the existing flux of 200 to 600 kg/yr is a high risk flux. The estimated dredging operation flux, using

EPA's improperly calculated predicted flux of one kg/day results in a flux predicted of more than 360 kg/yr. Thus, EPA anticipates as much or more flux than current condition estimates will be created during hot spot remediation. In fact, it is likely that the predicted flux rates during dredging are grossly underestimated based on direct extrapolation of pilot study data. Further, EPA has not provided supporting data for these numbers at this time despite the potentially critical environmental impact of this flux.

Although sediment resuspension rates were calculated for each of the dredging methods during the pilot study, EPA ignored natural resuspension rates or silting of the Harbor.

7.7.2 About 29 percent of resuspended material will escape beyond the 100 yard radius of the dredging site, according to results from the pilot dredging project. At higher rates of dredging, more material will be resuspended posing potential health and environmental impacts if EPA's toxicity assessment is correct, an issue that defendants contest.

7.7.3 The fact that elevated PCBs were not measured by EPA at the Coggeshall Street Bridge during the pilot study is equated to the prediction of similar conditions during "hot spot" dredging. EPA arbitrarily ignored higher concentrations, differences in currents and possible difference in phases of contaminants in the "hot spot" area which would result in significant increases in contaminant transport as a result of dredging.

7.7.4 Numerous technologies considered for implementation and some that were pilot or bench-scale tested, such as alkali metal dechlorination, were eliminated from consideration due to lack of historical implementation or full-scale pilot testing. This is contrary to EPA's own policy of technology innovation and the law, relied on by the Agency to support cleanups at a number of other Massachusetts Superfund sites. A decision to eliminate these alternatives should have been made before the bench and pilot tests since the criteria for their elimination was not related to the results of the tests. New Bedford Harbor should not have been utilized by the government for experimentation with technologies, after the Agency excluded them from review, since this was costly and unrelated to New Bedford Harbor cleanup.

7.7.5 Very promising results of pilot testing of advanced biological treatment is provided by Naragansett's work, but the work was unreasonably discontinued to optimize the process or evaluate the effectiveness of a scaled up process. The Agency's prior commitment to pilot testing of dredging alternatives prevented the evaluation of a technology which might have provided a better solution at a lower cost and with a lower environmental impact.

7.7.6 The "Overview of the Bench-Scale Treatment Technology Test Program, New Bedford Harbor Feasibility Study" Ebasco Services, Inc., August 1989 states that considerable research and process development is needed to implement enhanced biodegradation and more specific information is needed to compare effectiveness, implementation and cost. These arguments apply with equal force to the recommended alternatives. Handling heavy metals with incineration, in particular, requires additional research and process development prior to design. Indeed, much additional information is needed to compare the effectiveness, implementation and cost of alternatives. This is another example of the arbitrary nature of the alternative evaluation process.

7.7.7 The summary of water treatment in the HSFS is unclear how treatment will be conducted. The technologies being considered can be extremely expensive to operate, and without an understanding of the operations for the potential contaminant removal requirements, accurate cost estimates and evaluation of technologies cannot be prepared. Major elements of the plan are uncertain, although very specific cost estimates have been developed.

7.7.8 The discussion of enhanced in-situ biodegradation on p. 5-37 discards the consideration of the alternative prior to its development for consideration because the technology has not been successfully demonstrated in a marine environment. Contrary to law, no serious attempt is made to consider engineering methods which might make this technology feasible.

7.7.9 Other in-situ technologies are likewise dismissed out of hand without any serious consideration of their potential merits.

7.7.10 The assertion on p. 5-37 that capping would only be likely to be implemented in select areas not subject to strong hydrodynamic forces is a short-sighted argument. If capping could not be implemented in such areas for the reasons dredging certainly would cause significant sediment resuspension in the same places. The HSFS is arbitrarily inconsistent in its approach to the evaluation of technologies, using criticisms to invalidate some alternatives while ignoring those critical issues in the evaluation of others.

7.7.11 The cost-effectiveness of the BEST extraction process is questionable since three and six extraction steps were required in a bench-scale test. Since bench-scale tests are usually more efficient than both pilot and full-scale tests, these results may be questionable in full-scale operation.

7.7.12 The study states that the "apparent immobilization" of heavy metals in the BEST extraction test may preclude the need for secondary treatment of the sediments for those metals. Since process pH, sediment pH, and residue pH values are not given, additional investigation would be warranted before this could be safely asserted.

7.7.13 The BEST extraction solvent, TEA, is toxic by ingestion and inhalation and has caused liver and kidney damage in exposed animals. The solvent could have adverse health effects on workers. These facts were arbitrarily excluded from the HSFS.

7.7.14 The problem descriptions for liquified gas extraction are major and should preclude it from further consideration. The fact that this innovative technology remained, but other innovative approaches were excluded, is capricious.

7.7.15 Although the RCC B.E.S.T. process has operated at a demonstration scale at a Savannah, Georgia superfund site, its operation and extraction efficiency using the new washer-drier equipment has not been proven at either the pilot or commercial scale. Few if any tests have been conducted with this new technology to assess its contacting and extraction efficiency. Similarly, it is not clear that the solids handling problems are minimized using the washer-drier equipment because the time required for settling the fine particles from the harbor sediments could be quite long necessitating numerous washer-driers to achieve the required capacity.

7.7.16 Many of the problems noted in the CF Systems tests using liquid propane should be anticipated with the RCC B.E.S.T. process. This is particularly true since the B.E.S.T. evaluation was only done at the bench scale and problems specific to the harbor sediment such as solids handling, solids carryover and PCB accumulation would not have been observed except in the pilot plant or commercial scale operation.

7.7.17 It appears that the Alkali Metal Dechlorination process (KPEG) could have been eliminated because of material balance problems in the lab tests or problems in the analytical inspections.

7.7.18 In evaluating the dewatering options, the primary objective appeared to be achieving the driest cake possible, thus the selection of recessed chamber (plate and frame) filters. For some downstream treatment options such as infrared or rotary kiln incineration, the driest cake achievable may be the most desireable, while for others it may not be, and little economic penalty may be incurred for having somewhat more water with the solids. For example, solids handling for a fluid bed incinerator or a solvent extraction process may be simplified if the sediments are pumpable rather than being moved by augers or conveyors.

Although bench tests were conducted to evaluate the applicability of filters to the hot spot sediments, consideration must be given to the difficulty of adequately conditioning sediments containing high oil concentrations. It is well known that sludges containing high levels of oil are prone to blind the filter cloths and finding suitable conditioning systems can be difficult.

Given the potential desirability of a pumpable feed and the problems of filter cloth blinding with oily sediments, centriges should be considered as an alternative to filtration for pretreating the sediments.

7.8 COMMENTS ON DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

7.8.1 Although the objective of the screening of alternatives was stated as elimination of alternatives while still preserving a range of options, EPA did not comply with its own RI/FS guidance. In fact, dredging and treatment was the only real option evaluated. A fair evaluation of the other options was not conducted and a full analysis of only one treatment alternative was carried out.

7.8.2 The increased mobility of contaminants during implementation of a containment alternative is cited. Proper design and implementation could avoid such mobilization, but the HSFS selectively ignores the possibility of engineered solutions to operational problems. It also disregards the increased mobility of contaminants during dredging operations.

7.8.3 The results of the pilot study are cited as evidence that installation, positioning and removal of a silt curtain causes a significant amount of sediment resuspension, but no attempt is made to quantify the resuspension or relate it to the calculated resuspension over the duration of a dredging operation. Furthermore, it is hard to conceive how placement of a silt curtain causes resuspension of concern, but dredging does not.

7.8.4 Several potential geotechnical issues related to capping are mentioned: the long-term effectiveness, the bearing strength of the underlying sediment, mixing of sediments during installation, formation of a mud wave, and resuspension of sediments. No detailed discussion of possible engineered solutions to these issues is attempted and no backup data is presented to demonstrate that these potential problems would be likely for this site. It is difficult to justify the argument that the underlying material is not sufficient to support a cap when the U.S. Army Corps has just constructed a CDF in the upper estuary. This is another example of the arbitrary exclusion of a reasonable alternative.

7.8.5 Under implementability, it is stated that the capping alternative would have to clear several hurdles to comply with the Clean Water Act. However, this argument is not used in the evaluation of the dredging alternatives and it is just as valid for those alternatives. In fact, EPA has already destroyed valued wetland in the cove where it built a CDF for pilot dredging spoils. This is another example of a pre-judged arbitrary evaluation of alternatives.

7.8.6 In the elimination of capping as an alternative the HSFS postulated increased sediment mobility. All of the alternatives, except no action, will cause increased traffic in the estuary and increased sediment mobility, but this issue is not raised for the pre-selected successful alternatives, and no attempt at quantifying relative sediment mobilization for various alternatives is attempted. The containment alternative is no different except that it will cause <u>less</u> sediment resuspension.

7.8.7 The conclusion relative to capping is based on a series of unfounded, undocumented speculations. The idea that this "alternative is expected to cause an increase in PCB mobility" is clearly contrary to field and laboratory experience that the USACE has with capping in Long Island Sound and Puget Sound.

7.8.8 The capping alternative would decrease the mobility, toxicity and volume as a result of containing the sediments while biodegradation occurs under the cap. Since the HSFS recognizes that biodegradation does occur, a reduction in mobility, toxicity and volume follows directly.

7.8.9 Figure 6-4 which presents the advantages and disadvantages of the containment alternative is not consistent: reduction of mobility is listed as an advantage while lack of reduction of mobility is listed as a disadvantage; the same treatment is afforded to the risk, reliability, potential for replacement, maintenance and long-term reliability criteria. This treatment indicates that the evaluators conducted an inadequate assessment and expect that a poor design and implementation will occur. For example, the listed disadvantage of disturbance would be minor if implemented correctly. Finally, lack of compliance with ARARs is listed as a disadvantage, while the report states that the remedies being considered do not have to satisfy ARARs, and, in fact, none of the alternatives being considered will satisfy ARARs. Compliance with ARARs is not evaluated at all for the dredging alternatives. Again, application of the criteria in evaluating this alternative differs from the treatment afforded the "preferred" alternatives. A consistent evaluation of alternatives was not provided.

7.8.9 Figure 6-4 states that capping does not reduce the magnitude of the residual risk although the HSFS acknowledges that most of EPA's estimated risk is due to direct contact with contaminated sediments. A cap, however, would eliminate EPA's hypothetical risk, since a cap by its nature prevents contact with sediment.

7.8.10 In Figure 6-5, which evaluates a second containment alternative, EPA's argument that containment would increase mobility as it did for the first containment alternative. The discussion of the confined aquatic disposal (CAD) alternative states that pilot test results indicated that CAD cells could be constructed without significant resuspension. This certainly indicates that a cap could also be constructed without significant sediment resuspension.

7.8.11 The CAD alternative is eliminated due to purported questionable long-term reliability and the potential for PCB migration from the cells. Significantly, the data from the CAD portion of the pilot dredging study has not yet been collected and evaluated or disclosed to the public by EPA.

7.8.12 Under the discussion of a dredging alternative, the contaminant mobility as a result of boat traffic during implementation in dredging, is not mentioned as it was for the containment alternatives.

7.8.13 No disadvantages for incineration are noted in Figure 6-8. Air quality impacts and lack of treatment for metals, as well as uncertainties surrounding ash disposal, are arbitrarily not discussed.

7.8.14 A discussion of compliance with ARARs has been eliminated from consideration for all of the dredging alternatives, except containment alternatives.

7.8.15 Elimination of the containment alternatives according to Section 6.4, is due to three factors: lack of permanence, lack of long-term effectiveness, and lack of compliance with ARARs. Permanence would be achieved with containment alternatives until natural biodegradation effectively suffices to reduce the toxicity according to Lake et al. (1989) This degree of permanence can be engineered. The postulated lack of long-term effectiveness is only speculative. It is another engineering consideration for design and implementation. Effectiveness is not satisfied in the dredging evaluation since immobilization of metals in the treated solids is not adequately addressed.

7.9 COMMENTS ON THE DETAILED ANALYSIS OF ALTERNATIVES

7.9.1 Two requirements are listed on p. 7-1 relative to ARARs, but the report also states that ARARs do not have to be met. As stated previously, this is an inconsistency which was used in elimination of some alternatives.

7.9.2 Discussion of the no-action alternative arbitrarily excludes any data about natural siltation processes in the Harbor or biodegradation and biodechlorination observed by EPA contractors. The contaminants are being covered by natural processes.

7.9.3 The dredging analysis states that over-dredging will not be necessary. Given the shape of the "hot spot" area and the inherent inaccuracy in dredging techniques, it is unrealistic to believe that no over-dredging will occur. This has consequences for EPA's cost-estimates compromising EPA's present uncertainty bounds.

7.9.4 In evaluating alternatives, the section titles are given as "Reduction in Mobility, Toxicity, and Volume," whereas the criterion in the feasibility study guidance document is "Reduction in Mobility, Toxicity or Volume."

7.9.5 In all procedures where the sediment is handled (i.e, dredging, pumping, dewatering, etc.), the potential for release either in the water column or through volatilization is relatively high and should be quantified and related to some risk as compared to capping.

7.9.6 In Section 7.3.4, the HSFS states that dredging residuals will be 10 ppm or less, based upon engineering considerations of dredging sediment rather than a policy decision for a target cleanup level based on the protection of human health and the biota. The HSFS also states that the results of the pilot study indicate that 10 ppm is achievable. In the pilot study, achievement of a post-dredging level of 10 ppm was due more to the area location of where the study was performed than the mechanical ability of the dredge. It so happened that the sediments below the elevation where pilot dredging was completed had PCB concentrations of 10 ppm or less. It is improper to conclude as EPA has done that residuals in the "hot spot" will be 10 ppm or less, since the conditions in the "hot spot" area are radically different from those in the pilot study area.

7.9.7 The method for disposal of the water treatment sludge which will be contaminated by a variety of compounds is not addressed in the water treatment description. This omission is significant and shows that the health and environmental aspects of the EPA's preferred remedial alternative were not evaluated properly.

7.9.8 Per the material balance shown in Figure 7-2, the dredge will remove about 75 tpd of solids while the mechanical dewatering and incineration facilities will only be capable of processing 40 tpd. It appears that the dredge will be idle half of the time given the limited 8 day storage capacity of the CDF. It would seem prudent to alter the operating plan to fully utilize the dredge.

7.9.9 As the settling and clarification tests confirm, it is probable that a 20% solid sediment can be produced in the CDF. Given that the sediments in the harbor are 30% solids and must be removed by a dredge, it is likely that more than a simple pump will be required to remove the thickened (20%) sediment from the CDF and transfer it to the mechanical dewatering facilities.

7.9.10 If a 20% solids content stream can be consistently produced from the CDF, then consideration should be given to feeding it directly to the incinerator rather than providing more dewatering. Although this would increase the incinerator fuel consumption, as well as the incinerator gas processing system (due to more steam in the combustion gases), it could improve the overall efficiency by permitting solids handling by pumps rather than conveyors, eliminating the down time of the dewatering facilities, and eliminating the interfacing problems between the dewatering equipment and both the CDF and Incinerator. In most cases some surge storage will be required between a filter and the incinerator. This is especially true if a recessed plate filter press is used because it generates batches of filter cake rather than a continuous stream. The economic penalties of increased fuel usage must be weighed against the combined cost savings of no dewatering facilities and more efficient and simplified operations.

7.9.11 If a filter press (either recessed plate or gravity belt) is used for dewatering, filter feed conditioning will be required. For both filters, flocculating polymers will probably be required to prevent cake blinding. (EPA has not considered the potential health and economic considerations of these residuals.) For the recessed plate filter press, a filter cloth precoat or body feed may also be required given the small particle size of the sediments. The precoat or body feed would increase the total solids requiring disposal by 10% or more. Additionally, the presence of oil in the sediments aggravates the filter cloth blinding problem and finding a suitable flocculating agent(s) is more difficult. If the feed conditioning is less than optimal and filter cloth blinding occurs, then dewatering efficiency will be lower and the residual moisture in the filter cake will be higher. Filter testing of high oil content sediments should be conducted before committing to a filter for mechanical dewatering.

7.9.12 Particulate controls have been the most difficult emission requirements for incinerators to meet. This could be a particular problem with the hot spot sediments for two reasons. First, the particles are extremely fine and second, the relatively high concentrations of metals. It is known that some metals are volatile at incineration conditions when oxidized and particularly when chlorinated, and that when cooled in the gas treating train, they condense to from very fine particulates which are difficult to control and potentially toxic. More than routine attention must be given to the gas treating systems downstream of the incinerator.

Additional attention must be given to fugitive dust emissions of incinerator ash. A closed system should be included for receiving, transporting, storing and solidifying/stabilizing the ash.

The formation of HCL, especially when high concentrations of PCB are burned, will require special attention to materials of construction and scrubber operations to prevent chloride emissions.

7.9.13 The required dosage of solidifying/stabilizing agent is dependent on both the required physical properties of the product as well as the form of the metals to prevent their leaching. Standards defined for both the physical properties and the leachability of the solids so that the required volume of fixation agent can be established. If very rigorous requirements are imposed, then more than a 1/2 to 1 ratio of fixing agent to ash ratio may be required. It must also be recognized that some metals will retard the solidification process and provisions must be added to accommodate additional setting time. Finally, in addition to the incremental weight of the fixing agent added to the ash requiring disposal, the water of hydration must also be added further increasing the weight of material requiring disposal.

7.9.14 The availability of mobile incinerators designed for treating PCB contaminated solids is limited. (The Hazardous Waste Business publication of July 5, 1989, reports that only three companies have approved transportable units available.) Given that infrared and circulating beds may not be the incinerators of choice, there are a limited number of rotary kiln units available. These units may not be as readily available as implied in the report.

7.9.15 Table 7-2. In many cases the cost of utilities and chemicals are not included in the contracted cost provided by the dewatering or incinerator contractor. The cost estimate in Table 7-2 should include the power and fuel for the incinerator, and the feed conditioning chemicals for the mechanical dewatering.

7.9.16 EPA failed to conduct a cost-effectiveness analysis. The cost estimate of Item I, Disposal of Solidified Ash in Shoreline CDF (unlined), which is presented in Table 7-2, could be $5 to $10 million, as opposed to the $221,000 estimated, because the evaluation of the treatability and disposal of the ash is incomplete. This cost renders the HSFS analysis inadequate, and it would raise the overall cost of the alternative to over $25 million without any other changes. If a true cost-effectiveness analysis had been performed, for an operable unit, as required, or if the estimate had been 50 percent higher, the decision to implement this alternative would probably have been different.

7.9.17 In the analysis of alternatives, no information is given on how the CDF effluent filter backwash water will be handled. In addition, no discussion of regeneration or disposal of the activated carbon is presented, although carbon regeneration facilities will not accept PCB-contaminated carbon, and the spent carbon must be incinerated. The final closure of the CDF area is not addressed, either, and costs for final closure and for transport and incineration of the carbon are not included in the cost estimates.

7.9.18 In constructing an alternative cost estimate each item should be evaluated under a worst-case scenario in order to establish an upper bound for that task. The sum of the upper bounds would provide an upper range for the entire effort. Although calculation of an upper bound is common engineering practice, this exercise has not been conducted in the HSFS. It is hard to imagine how a rational decision could be made without such an analysis.

7.9.19 The handling of the metals residuals problem in the HSFS and in EPA public presentations on the alternative remains unsatisfactory. The selected alternative has not even been shown to be effective for heavy metals at the bench scale and yet it was selected for implementation while other technologies that had the demonstrated potential to immobilize the metals were analyzed and discarded because they had not been demonstrated in the field. Examples include capping, biodegradation and BEST solvent extraction.

7.9.20 The discussion of the BEST process does not describe the solvent/solid mixing equipment, nor does it give the water balance for solvent extraction. The amount of water to treatment in tons per day is approximately 38, if the moisture in the treated solids is about 10 percent, which would be typical for heat dried material. This water should be added to the water treatment analysis section of the process.

7.9.21 Economics of the BEST process require maximum recovery of the TEA solvent. Since there are many potential loss routes for the solvent, minimizing these losses requires energy expenditure in the form of reflux streams, extending heater residence items, etc. No judgment on the treatment costs can be made without more process, details and an estimation of the efficiency of the solvent recovery.

7.9.22 Temperature is not listed as a parameter for the BEST process despite the fact that the variation from summer to winter will affect both contaminant solubility and mass transfer coefficients.

7.9.23 Although it is stated that fugitive dust emissions will be controlled, for each of the unit processes in the treatment train, no analysis is in the HSFS to show what the expected levels will be and how those would be controlled. Since fugitive emissions are often not technically feasible to control, this is an important omission on the report with potential human health and environmental consequences.

7.9.24 Precise estimates are given for solidification of ash residuals from incineration, despite the fact that a process that will work has not been identified. If a process has not been identified, let alone selected, any cost estimates are highly uncertain.

7.9.25 The ash solidification discussion does not indicate how the appropriate additive will be found or what criteria will be used for selection, nor does it inform the public of how they will be informed of the final alternative so that a proper analysis can be performed and comments can be filed.

7.9.26 The overview of the bench-scale technology test program discusses the five technologies that were bench-tested:

- in-situ vitrification
- KPEG
- dewatering
- biodegradation
- BEST solvent extraction

The report states that tests were used to determine the effectiveness and potential material handling problems and to refine the cost estimates for each method. In reviewing this document with other EPA documents, it is apparent that in situ vitrification, KPEG, biodegradation and BEST were all eliminated for reasons that could have been or were identified prior to the initiation of the bench-scale test. Therefore, these tests did not provide any data that either verified the feasibility and applicability of the technology for New Bedford Harbor or helped to refine the cost estimates.

The only bench-scale test that had the potential to aid in the evaluation of alternatives was the dewatering study. As presented, it is a one page letter with an attached list of numbers. In its present form, it is inadequate and does not represent even a reasonable presentation of a pilot test of dewatering that can be used to evaluate material handling problems and to refine cost estimates which were two of the objectives of performing the bench scale studies. In fact, at the end of the bench scale testing, two of the greatest areas of uncertainty relative to the selection of alternatives were materials handling problems during dewatering and the cost estimate for the recommended alternative.

7.9.27 EPA's preferred alternative calls for substantial dredging which will lead to consequent aeration of sediments remaining in situ. This will disturb indigenous bacteria, and particularly anaerobes. Since this group of bacteria are currently metabolizing PCBs, the rate of naturally occurring degradation and dechlorination will be potentially reduced.

7.9.28 A significant number of potential environmental problems exist for the remedial measures favored by the HSFS. Both scenarios involve treatment of large volumes of wastewater to remove PCBs; however, the HSFS does not discuss whether a technology existed for this. Since none of the systems tested during the pilot study came close to meeting criteria, the HSFS discusses testing additional flocculants or using UV/peroxides. Release of toxic peroxide residues into the environment could produce additional environmental risks as could release of flocculants; neither of these problems are addressed. Also the efficacy of the wastewater treatment system relative to the removal of heavy metals or toxic organics was not considered.

7.9.29 The HSFS discusses a discharge criterion of 1 ppb PCB from the CDF for the water treatment system. Such a discharge will raise the dissolved PCB fraction above present background levels, increasing the flux.

7.9.30 About 800 pounds of solids will have to be removed from the wastewater stream each day. Since this material will be classified as hazardous waste, the filter material trapping it and the flocculants added will also have to be disposed of as hazardous waste. The HSFS has failed to consider these factors in the cost estimates.

7.9.31 The incineration remedial plan seriously underestimates the concentration of heavy metals in the residual ash. The HSFS states that incineration will "produce ash, which will contain metals at concentrations near those observed in the untreated sediment." However, incineration will remove all water and the 10 percent organic content. Assuming an initial sediment water concentration of 30 to 60 percent, the resulting ash will be about half the weight of the sediments dredged. Assuming that incineration will not volatilize heavy metals, it is likely that the metals concentrations will double, radically compromising EPA's cost evaluation for incineration.

7.9.32 The plan for solvent extraction of PCBs may have unknown environmental dangers. The residue will contain the original levels of toxic metals and an unspecified amount of extraction solvent will be lost to the environment. The HSFS provides no information about the environmental risks of TEA, except to note that it is toxic to aquatic organisms. Information should be provided about the residual levels of the solvent in the waste stream.

7.9.33 The HSFS analysis of alternatives leads to the conclusion that dredging in general and dredging and incineration of the sediments, in particular, were foregone conclusions based on the framework established for the evaluation of alternatives and the justification established for elimination of those alternatives eliminated from further consideration during the course of the Feasibility Study. The following is a summary of the alternatives that were theoretically considered during the Feasibility Study and the rationale for their elimination from consideration.

TABLE

ALTERNATIVE	REASON FOR ELIMINATION
No Action	will not reduce site risk
Capping	inconsistent with reduction in mobility toxicity or volume; will increase PCB mobility; may not comply with CWA ARARs
Containment with Embankment	inconsistent with reduction in mobility toxicity or volume; will increase PCB mobility; may not comply with CWA ARARs
Dredge and CAD disposal	questionable long-term reliability; potential for PCB migration from the cells
Dredge and off-site landfill	failure to treat permanence or reduce volume; limited availability of landfill capacity
Dredge and incinerate on-site	recommended alternative
Dredge and solidification	technology not proven
Dredge and solvent extraction	technology not demonstrated
Dredge and off-site incineration	not cost-effective

As can be seen from the above summary, each of the considered alternatives that was eliminated was eliminated due to the fact that it was an unproven technology or that it could not meet one of the criteria. Any of these reasons could have been identified prior to the development of the alternatives or the detailed analysis. The ARARs criterion was not consistently applied, as the dredging alternatives were deemed to be exempt from ARARs, while the containment alternatives were not. As a result, dredging and incineration was

virtually a preconceived conclusion.
As can be seen from the above list, many of the technologies for which pilot studies were conducted, including vitrification, biodegradation, and alkali dechlorination were not even included in the evaluations. The reasons these were eliminated were again for reasons that could have easily been predicted prior to the initiation of the studies as judged by EPA's framework and criteria utilized in the HSFS. Those pilot studies need not have been conducted, based on EPA's evaluation methods applied in this study.

On Page 7-1 of the HSFS, it is stated that "the detailed analysis of alternatives is intended to provide decision makers with sufficient information concerning a range of proposed remedial actions." The method for screening and elimination of alternatives did not provide decision makers with such a range, as virtually all of the technologies and alternatives considered were eliminated due to the lack of data or demonstrated capability.

7.9.27 On Page 12 of Engineering Feasibility Report No. 11 (Averett D.E., M.R. Palermo, M.J. Otis, and P.B. Rubinoff - Evaluation of Conceptual Dredging and Disposal Alternatives, Report No. 11, Engineering Feasibility Study, July, 1989), the migration pathways related to upland disposal are listed and include surface water, leachate, groundwater, volatilization, and bioturbation. The HSFS failed to analyze these migration pathways for the short-term and the long-term environmental impacts relative to the temporary and permanent disposal aspects of the recommended alternative.

7.10 CONCLUSION

The analysis of alternatives presented in the HSFS is inconsistent in its evaluation of containment and dredging alternatives and inadequate in its evaluation of costs for both recommended and discarded options. A compelling argument for remediation of the "hot spot" prior to evaluation of the entire Harbor is presented and, in fact, evidence is presented which indicates that preliminary remediation might be detrimental.

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